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ABSTRACT

This package contains an instructor's manual, an instructor's resource package, and a student workbook for a course in agricultural production and management as it relates to crop production. The module contains 17 units of instruction, each of which contains some or all of the following components: objective sheet, instructor's guide, information sheet, assignment sheet, job sheet and skill test record, written test, answers to assignment sheets and written test, transparency masters, learning activity package (LAP) sheet handouts, and other required media. These components are organized within three sections as follows: (1) instructor's manual--information on measuring student performance gains, required criteria for a competency-based education program, a curriculum and duty-task matrix, a basic skills matrix, one set per unit of the instructor's guide, answers, and test code sheets; (2) instructor's resource section--a LAP sheet, transparency masters, and the written test; and (3) student workbook--objective sheets, information sheets, assignment sheets, and job sheets. Unit components are tied to measurable and observable learning outcomes, and most units of instruction are designed for use in more than one lesson or class period. The following topics are covered in the 17 units: introduction to soil, plant, and crop science; safety; careers; soils; soil sampling; fertilizers and irrigation; soil conservation practices; land uses and classification; land legal descriptions; growth and reproduction; seeds and plants; common pests; controlling pests; native and improved pastures; harvesting; marketing crops and grades; and price trends and cycles. A booklet describes the NPK$PLUS interactive software program on soil testing that is available from the Department of Agronomy, Oklahoma State University. (KC)

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Soil, Plant, and Crop Science

CE 069 988

CIMC

Teacher Edition

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Vocational and Technical Education
1500 West Seventh Avenue
Stillwater, OK 74074-4364

AG1008

Soil, Plant, and Crop Science

Instructor's Manual

Upfront

Curriculum/Duty Task Crosswalk

Instructor's Guide

Answers

Test Code Sheets

Developed by the
Curriculum and Instructional Materials Center
for the Division of Agricultural Education
Oklahoma Department of Vocational and Technical Education

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Curriculum and Instructional Materials Center

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TABLE OF CONTENTS

Instructor's Manual

Upfront

Foreword v
Preface vii
Acknowledgments ix
Use of this Publication xiii
Basic Skills in Curriculum xix
Measuring Student Performance Gains xxiii
Required Criteria for a Competency-Based Educational Program xxv
Corrections and Suggestions xxvii

One set per unit of the following components:

- Instructor's Guide
- Answers
- Test Code Sheets

Instructor's Resource Package

One set per unit of the following components:

- LAP Sheet
- Transparency Masters
- Written Test
- Other required media

Student Workbook

One set per unit of Objective Sheets, Information Sheets, Assignment Sheets, and Job Sheets for the following units:

SECTION A

Unit 1 Introduction to Soil, Plant, and Crop Science A1-1
Unit 2 Safety A2-1
Unit 3 Careers A3-1

SECTION B

Unit 1 Soils B1-1
Unit 2 Soil Sampling B2-1
Unit 3 Fertilizers and Irrigation B3-1
Unit 4 Soil Conservation Practices B4-1

SECTION C

Unit 1 Land Uses and Classification C1-1
Unit 2 Land Legal Descriptions C2-1

SECTION D

Unit 1 Growth and Reproduction D1-1
Unit 2 Seeds and Plants: Selection, Preparation, and Planting D2-1
Unit 3 Common Pests D3-1
Unit 4 Controlling Pests D4-1
Unit 5 Native and Improved Pastures D5-1
Unit 6 Harvesting D6-1

SECTION E

Unit 1 Marketing Crops and Grades E1-1
Unit 2 Price Trends and Cycles E2-1

FOREWORD

Agriculture in today's society requires the operator to be highly motivated and to be a specialist both in management and production in order to survive in the competitive world market. Oklahoma's agricultural education programs offer excellent opportunities in many production, management, and entrepreneurship areas. This publication was designed to provide students with highly technical information that will lead to success in the workplace, aid in worksite learning, and provide additional skills that will allow that student to be a success in the transition from school to work.

Soil, Plant, and Crop Science contains units which highlight many of the specialist areas in the series entitled Agricultural Production and Management. Today's students need to be challenged to not only learn skills, but to realize how these skills apply in the work place. It is hoped that this specialist core of knowledge will serve as a bridge to higher educational levels, greater achievements, and higher levels of competencies.

Eddie Smith
State Supervisor
Agricultural Education
and State FFA Advisor

PREFACE

This publication, *Soil, Plant, and Crop Science*, is the second in the Agricultural Production and Management series. This is a substantial revision of the *Agriculture III and IV* curriculum. Instructors will find a more in-depth treatment of that subject matter, plus information on how to obtain up-to-date supporting materials.

In recent years, the jobs in agriculture receiving spotlight attention have been in processing, sales, and service. Statistics bear out the fact that those industries are where many jobs are to be found. However, students seeking jobs in any part of the industry will find that the skills offered in this curriculum will serve them well.

Randy Kirk
Instructional Development Specialist

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Randy Kirk
Instructional Development Specialist

Student Workbook

- Objective Sheets
- Information Sheets
- Assignment Sheets
- Job Sheets

Instructor's materials include the *Instructor's Manual*, the *Instructor's Resource Package*, and the *Student Workbook*.

Unit components are tied to measurable and observable learning outcomes. Instructor's are encouraged to supplement unit components with other resources to make units as responsive to local conditions and student needs as possible.

Most units of instruction are designed for use in more than one lesson or class period. Instructors should determine the following for each unit:

- amount of material that can be covered in each class period;
- skills that must be demonstrated;
- supplies and equipment needed;
- amount of class time needed for demonstrations;
- amount of class time needed for student practice;
- supplementary materials to be ordered; and
- resource persons who must be contacted.

Objective Sheet (Student Workbook)

The Objective Sheet summarizes each unit for the student and the instructor. The Objective Sheet includes the following sections:

Introduction – This section introduces students to the unit topic and its importance to them. The Introduction also relates the unit to students' experiences and their "need to know"; it helps capture their interest and focus their attention on the specific topic.

Prerequisites – This section is included if any of the units in the book have prerequisites. A prerequisite may be one or more units from the same book or from other books, which must be completed before beginning the unit. (If no prerequisites exist for any of the units in the book, this section is omitted.)

Focus Assignments – Each unit has two Focus Assignments: Prereading and Writing. The Prereading assignment requires the student to read appropriate sections from unit references, from the *Instructor's Resource Package*, or from the student's textbook. The Prereading assignment leads into the Writing assignment, which assigns students a short written activity based on the Prereading assignment. Because the Focus Assignments help promote the use of basic skills, they include appropriate basic skill icons and enablers.

USE OF THIS PUBLICATION

INSTRUCTIONAL UNIT

Each unit of instruction is based on the performance needed for successful employment in an occupational area. *Soil, Plant, and Crop Science* contains seventeen units of instruction. A complete unit may contain most or all of the following components: Objective Sheet, Instructor's Guide, Information Sheet, Assignment Sheet, Job Sheet (and Skill Test Record), Written Test, Answers (to Assignment Sheets and Written Test), Transparency Masters, Learning Activity Package (LAP) Sheet, Handouts, and other required media. These components are organized within three packages, as follows:

Instructor's Manual

- Upfront pages (title page, copyright page, table of contents, foreword, preface, acknowledgments, measuring student performance gains, required criteria for a competency-based education program, and corrections and suggestions)
- Curriculum and Duty/Task Crosswalk
- Basic Skills Matrix
- One set per unit of:
  - Instructor's Guide
  - Answers
  - Test Code Sheets

Instructor's Resource Package

- One set per unit of:
  - LAP Sheet
  - Transparency Masters
  - Written Test

  ☑ **NOTE:** The three components listed above may be photocopied by the instructor.

- Handouts (as appropriate)
- Other required media (as appropriate)

Unit Objective – The Unit Objective states the overall goal of the unit. It identifies what the student will be able to do after successfully completing the unit, as well as the standards used to measure student performance.

Specific Objectives – The Specific Objectives outline the teaching sequence of the competencies required to reach the Unit Objective.

The Specific Objectives on the Objective Sheet should be emphasized to all students at the start of each unit and throughout the teaching/learning process. This will help answer student questions about performance requirements for each unit. Specific Objectives can also assist instructors in determining teaching strategies and instructional methods. Instructors should prepare for each unit by deciding how each objective could best be taught.

Instructors should modify, delete, or add objectives to meet the needs of students and the community. When objectives are added, the instructor should remember to provide the needed information, Assignment and/or Job Sheets, and criterion-referenced test items.

Information Sheet (Student Workbook)

The Information Sheet provides the "must know" content essential for meeting the cognitive objectives in the unit. Information is usually presented in print on the Information Sheet, but may also be presented in other formats, if appropriate, such as on videotape, software, or other media. (Additional formats for presenting the Information Sheet objectives allow this component to be interactive.)

Many objectives on the Information Sheet begin with a "Words You Should Know" section. This boxed item identifies terms relating to the objective, and gives a definition for each. Terms in the "Words You Should Know" boxes are tested only indirectly with the objective information (not on the Written Test as a matching exercise).

The Information Sheet may include clarifying NOTES and EXAMPLES, as needed. In the left column, students and instructors are reminded of the optional and/or required activities and resources available for a particular objective.

Students should read the Information Sheet for each unit before it is discussed in class. Space is provided in the margins for both students and instructors to add notes that clarify and/or expand upon the information presented.

Assignment Sheets (Student Workbook)

The Assignment Sheets address the learning levels at or above the application level of Bloom's taxonomy. They allow students to perform non-psychomotor activities related to occupational tasks. Assignment Sheets also provide students with an opportunity to use higher-order thinking skills, such as problem-solving, synthesizing, analyzing, and evaluating. In addition, they may provide opportunities for cooperative learning and more detailed oral/written communication activities.

Assignment Sheet activities can be "paper and pencil" activities, as well as those using computer software, videotapes, models, handouts, or other resources as appropriate. All Assignment Sheets include basic skills icons and enablers (identified in the left margin).

Job Sheets (Student Workbook)

Job Sheets gives students step-by-step procedures for performing manipulative or psychomotor occupational tasks or jobs. The Job Sheet also functions as a Skill Test Record, facilitating the instructor's evaluation of each student's performance. Both the process and the end-product are evaluated. Diagrams, illustrations, and photographs are included, as needed, to assist students in completing the job.

Individual Job Sheets may include various warnings written to conform to the latest specifications of the American National Standards Institute (ANSI). DANGER is used if the situation *will* lead to death or serious injury if not avoided; WARNING is used if the situation *could* lead to death or serious injury if not avoided; CAUTION is used if the situation could lead to minor or moderate injury; NOTICE is used if the situation could cause property damage only; and IMPORTANT is used to refer to operating or maintenance tips. Each type of warning appears on the Job Sheet with an ANSI symbol.

The instructor should demonstrate the procedure outlined in each Job Sheet. Instructors may also have to localize specific procedures.

Instructor's Guide (Instructor's Manual)

The Instructor's Guide leads instructors step by step, objective by objective through the unit. It recommends instructional strategies for the Focus Assignments and for each of the Specific Objectives. Resources and activities are labeled "R" for "Required" or "O" for "Optional." Optional and Required resources (publications, videos, computer software, and other media) are listed, as well as unit references. These resources can be used to supplement the instructor's knowledge of the subject area and to help students with particular interests or occupational objectives. In addition, the Instructor's Guide provides guidelines for evaluating student performance.

Instructors should study the Instructor's Guide before introducing the unit and allow time to obtain supplemental materials, prepare audiovisual materials, and contact outside resource persons. Specific tasks of the instructor will vary with each unit.

Answers (Instructor's Manual)

This component lists the answers to all of the Assignment Sheets and the Written Test questions.

Test Code Sheet (Instructor's Manual)

The Test Code Sheet matches Written Test questions to objectives. Basic skills codes are listed in chart format for each question. Each unit has a Test Code Sheet. For more information, see the CIMC publication *Measuring Learning & Competency Gains: The Pretest/Posttest Approach.*

LAP Sheet (Instructor's Resource Package)

The LAP (Learning Activity Package) Sheet for each unit allows the instructor to individualize instruction for some or all students. The LAP Sheet guides the student through each unit step by step, ensuring that the student receives the necessary instruction.

Transparency Masters (Instructor's Resource Package)

Transparency Masters are provided so that instructors can make transparencies to accompany specific units. Transparencies allow students to *see* as well as hear the information being presented, thus reinforcing the learning process. They also direct attention to the topic under discussion. Transparencies should be made from the Transparency Masters and placed where they will be readily available when needed. Transparencies should be left on the screen only when the related topics are under discussion.

Each Transparency Master also appears in the appropriate unit in the Student Workbook, at the location where the information is referenced (such as a Figure on the Information Sheet).

Written Test (Instructor's Resource Package)

The Written Test provides criterion-referenced evaluation of the Specific Objectives from the Information Sheet (Assignment Sheet and Job Sheet objectives are not evaluated by the Written Test). If instructors have added, deleted, or modified any objectives, appropriate changes should be made to the Written Test as well.

The Written Test serves as both a pretest and a posttest. In order to measure and document student competency gains as required by the latest Carl Perkins regulations, and as outlined in the Oklahoma-developed system of standards and measures, it is *essential* that the same test be used as a pretest and as a posttest. If instructors choose to use tests other than the Written Test, they should make sure that the same instrument is used for each activity – pre- and posttest.

The Written Test may be photocopied for classroom use, or additional copies may be ordered from the CIMC by calling 1-800-654-4502, or (in Oklahoma) 1-800-522-5810, ext. 589.

A detailed explanation of the Oklahoma plan for standards and measures and the Carl Perkins requirements is included in the CIMC publication *Measuring Learning & Competency Gains: The Pretest/Posttest Approach.* This booklet – and accompanying software to assist in calculating and recording student gains – are available to Oklahoma instructors through their school's vocational testing liaison.

To further assist instructors, the CIMC develops Test Code Sheets for each Written Test in its more recent publications, including this one. (These sheets are explained in detail in the publication mentioned above.) The Test Code Sheets assist in verifying that the Written Test is a valid instrument for measuring student learning and competency gains.

COMPETENCY PROFILES

A Competency Profile is available from the CIMC. Competency Profiles document student performance. Each profile lists the specific competencies covered in the book, and provides space for recording the student's level of performance on each competency.

PAGE NUMBERING

Each unit and each page in a CIMC publication has a number, shown in arabic numerals. The page number gives the package title, the book title, the component name, the unit number, and the page number within the unit. For example, the page number for page 1 in Unit 6 of the *Student Workbook* would appear as follows:

STUDENT WORKBOOK – Soil, Plant, and Crop Science
OBJECTIVE SHEET - **CIMC** - D-6 - 1

METHODS OF DISSEMINATING MATERIAL

For best results, provide each student with a copy of the Student Workbook. Students should be allowed to keep their Workbooks at the end of the course or training program.

TEACHING METHODS

Keeping students motivated is a challenge. Supplement each unit with current information, personal experiences, and other information. In a group setting, prepare for each unit by determining the best way to teach each objective, and allow for student input. For individualized instruction, provide opportunities for the student to become involved in planning and being responsible for his or her own education.

BASIC SKILLS IN CURRICULUM

The CIMC has always been mindful of the importance of reinforcement (and sometimes remediation) of students' academic skills as they progress through vocational training, and has always included activities in its materials to enhance and promote use of these skills.

Recent state and federal legislation mandates vigorous basic skills development in vocational education in the wake of demands by industry that workers *must* be academically, as well as technically, competent, given the nature of the highly complex work place. In response, the CIMC has taken the following steps to document that, indeed, the instructional materials *do* combine academic skills training with the vocational training. In addition, concerted efforts have been made to "beef up," or enhance the basic skills instruction already present. Following is a brief description of those processes:

Basic Skills Icons and Enablers

To assist teachers and students in identifying activities that promote basic skills development, the CIMC has implemented a marking system that uses simple graphic symbols, or icons, and a list of specific tasks, or enablers, to identify the basic skill or skills that are called for in each job or assignment sheet.

Each of the nine broad skills areas–reading, writing, mathematics, science, oral communication, interpersonal or relating, creative thinking and problem solving, employability, and social studies–is represented by the icon presented below.

Reading

Science

Creative Thinking/ Problem Solving

Writing

Oral Communication

Employability

Math

Interpersonal or Relating

Social Studies

When an activity involving one of these basic skills is identified, the corresponding icon is placed in the left-hand margin of the job or assignment sheet. The basic skills training is further defined by retrieving the specific, or enabling, skill that is required by consulting a list of over two hundred and fifty enablers that has been compiled and grouped with each general basic skill. This enabling skill is placed directly below the icon.

As an example, an exercise that requires a student to conduct library research would make necessary the use of specific reading comprehension and research and reference skills. The basic skills that the exercise promotes would be depicted in the left-hand margin as follows:

ASSIGNMENT SHEET

PLANNING LIVING SPACE FOR HUMAN NEEDS

1

Name ______________________________ Score __________

OBJECTIVE 10

Define personal territory.

INSTRUCTIONS

Reading Comprehension
- Gain factual information

Functional Reading
- Follow written instructions
- Use content area vocabulary

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

- As discussed in Objective 1, each person has an invisible "space bubble" or comfort zone. A comfort zone is the space between oneself and others that brings a feeling of well-being. When one's comfort zone is crowded or invaded, discomfort often results. Therefore, personal territory needs should be a prime consideration when planning living space.
- For each of the following situations, draw your estimated comfort zone around the figures provided.
- Indicate how many inches from your body the comfort zone extends.
- Consider how that comfort zone changes in different situations. Answer the questions that follow.

Basic Skills Documentation Matrix

Another component of the CIMC basic skills instructional plan is the "Basic Skills Documentation Matrix." The matrix graphically summarizes the basic skills training included in the vocational program, unit by unit. It should be helpful to teachers in planning their instruction, and to administrators as documentation that basic skills **are** being addressed during the vocational training.

The matrix for this publication is included as an 8½" by 11" foldout in this *Instructor's Manual.*

Matrices have been developed for most CIMC publications. For more information on those available for other programs, call the CIMC at 1-800-654-4502.

MEASURING STUDENT PERFORMANCE GAINS

When you examine this book, you will notice that separate written pretests are no longer included in the units of instruction. Each CIMC unit now contains only a single Written Test. This test should be used as **both** pretest and posttest by giving it once before students start a unit and again when they have completed the unit.

The reason for using a single instrument as both pretest and posttest is so that direct comparison of each student's competencies before and after instruction can be made accurately. This comparison enables precise calculation, documentation, and evaluation of student **performance gains**.

Accurate performance gains analysis is an important requirement of the new Carl Perkins legislation for vocational education. Teachers can make an important contribution to the performance accountability mandated by the new federal legislation by carrying out accurate performance gains analysis for their students, and making this data available to students, parents, and administrators.

This analysis is easy to do and requires only simple calculations and record keeping. Detailed information regarding performance gains analysis is contained in the CIMC publication, *Measuring Learning & Competency Gains: The Pretest/Posttest Approach.* In addition, the CIMC has developed a computer program, CARL, which will perform all necessary calculations and will print out a record form of all information required for gain score analysis. Copies of CARL and the publication are available through your local testing liaison (in Oklahoma), or from the CIMC at 1-800-654-4502.

REQUIRED CRITERIA FOR A COMPETENCY-BASED EDUCATION PROGRAM

Criterion	**Discussion**	**CIMC component meeting criterion**
1. Instruction is based on clearly-stated learning objectives that are: a) observable and measurable, and b) communicated in writing to students before instruction begins.	Learning objectives drive CBE. Objectives are the "competencies" that learners must achieve. Each objective must clearly state what *learners* must *do* to demonstrate acquired skill or knowledge. Verbs in learning objectives are active and precise, stating the exact performance expected of learners. The objectives should also specify the standard or level of performance required. Objectives can be at any level of Bloom's Taxonomy and can include the cognitive, psychomotor, and affective domains. Higher-order cognitive skills should be included.	Objective Sheet
2. Instruction is aligned with the stated learning objectives	In CBE, the objectives specify what is taught. "Content" should relate to one or more objectives. The curriculum should cover all objectives with relevant information.	Information Sheet
3. There is a student evaluation system that is: a) criterion-referenced, and b) aligned to the learning objectives and the curriculum.	In CBE, the aim is to bring the performance of *all* learners up to a pre-defined standards and competencies. Learners work on each competency until they achieve "mastery"; the evaluation system should test and record this mastery. Learners can restudy and retest as often as needed. Specific remediation activities should also be available to learners when needed. The evaluation system focuses on what each student has achieved, not on what the instructor has "taught." The "constant" in CBE is student performance; the "variables" are time and resources. (This differs from traditional systems where learners get one chance at mastery; some succeed and some fail. In such systems, time and resources are constant and student achievement is variable.) If an evaluation is criterion-referenced, successful learner performance is defined by (or *referenced* to) mastery of pre-set objectives and standards (or *criteria*): there must be a careful match (or *alignment*) between what the student should master (objectives), what is taught (curriculum), and what is tested. Objectives, curriculum, and evaluation system must all match.	Written Test and Job Sheet/Skill Test

Criterion	Discussion	CIMC component meeting criterion
4. There is an observable management system of cognitive skill practice that provides for, promotes, and documents mastery learning.	For both cognitive and psychomotor skills, a CBE program must have a system of maintaining records of which skills and activities each learner has completed, which ones are in progress, and which ones have not yet been completed. Completion means "mastery"; no skill is completed until the learner has achieved the mastery level. The record system should promote feedback on student skill attainment to *both* instructor and learners, provide for remediation as needed, and encourage reevaluation of learner performance until mastery is achieved. Appropriate remediation strategies often should consider learning styles and other individual differences among learners. Learners should work on skills and activities until they achieve mastery. They should not be "passed on" without mastery. While learners may move ahead and work on other skills (i.e those for which all prerequisite skills have been mastered or those without prerequisites), work should also continue on the skills still requiring mastery. Students should not attempt higher-order skills until all prerequisite skills are mastered.	Assignment Sheet
5. There is an observable management system of psychomotor skill practice that provides for, promotes, and documents mastery learning.		Job Sheet/Skill Test
6. Skill mastery records are maintained for each learner, and learners have access to and make use of these records to monitor their skill acquisition.	Records should clearly indicate the skills each learner has mastered. One such record should profile or list the competencies that have been mastered and those to be mastered. Other performance indicators can be added and kept in a portfolio for each learner. Learners should have ready access to their portfolios to monitor their own progress in skill mastery and competency attainment.	Competency Profile

CORRECTIONS AND SUGGESTIONS

The Curriculum and Instructional Materials Center (CIMC) wants to provide vocational instructors and students with accurate and effective materials. Although the CIMC strives to maintain the highest standards of development and production, oversights sometimes do occur. If you find any errors in this or other CIMC publications, or have suggestions for improving their usefulness in vocational programs, please notify the CIMC staff. To do this, please identify the page(s) affected and write any comments to clarify the error or suggestion. Use the spaces below. Then, simply fold (bottom of page *upward*, top *downward*), secure, and mail.

This information will be used to correct the publication before the materials are reprinted. To ensure that the material is updated on a timely basis, notify the CIMC of necessary corrections as soon as possible after discovering the error.

2 Fold downward

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Soil Science Section

NO.	TASK	CIMC UNIT/ COMPONENT
A	**Manage a farm/ranch operation**	
A.01	Select improved pasture management practices	Section D, Unit 5, Assignment Sheet 3
A.02	Select enterprises	Farm Management
A.03	Select range management practices	Section D, Unit 5, Assignment Sheet 3
A.04	Determine best land use	Section C, Unit 1, Assignment Sheet 1
A.05	Estimate enterprise cash flow	Farm Management
A.06	Determine whether to buy or lease land	Farm Management
A.07	Determine whether to buy or lease facilities and equipment	Farm Management
A.08	Calculate needs and costs	Farm Management
A.09	Develop an enterprise calendar	Farm Management
A.10	Identify and use ASCS and SCS services	Section A, Unit 4, Assignment Sheets 3 and 4
A.11	Identify and use sources of current technical and management information.	Section A, Unit 4, Assignment Sheet 2
A.12	Interpret marketing trends and cycles	Section E, Unit 2, Assignment Sheets 1 and 2
A.13	Keep production records	Farm Management
A.14	Keep financial records	Farm Management
A.15	Determine insurance needs and costs	Farm Management
A.16	Interpret agricultural laws and liabilities	Farm Management

NO.	TASK	CIMC UNIT/ COMPONENT
A.17	Recognize environmental and animal welfarists concerns	Section A, Unit 2, Assignment Sheets
B	**Obtain credit**	
B.01	Formulate and communicate a credit proposal	Farm Management
B.02	Calculate interest	Farm Management
B.03	Complete credit applications	Farm Management
B.04	Compare and select sources of credit	Farm Management
B.05	Prepare a set of financial statements	Farm Management
C	**Plant a crop**	
C.01	Choose appropriate site for a specified crop	Section C, Unit 1, Assignment Sheets 1, 2, and 3
C.02	Operate tractor and equipment	Section B, Unit 3, Job Sheet 1; Section D, Unit 2, Job Sheet 3; Section D, Unit 4, Job Sheet 2;
C.03	Select and prepare seeds	Section D, Unit 2, Job Sheet 1
C.04	Take a soil sample and interpret results	Section B, Unit 2, Assignment Sheet 1, Job Sheet 1
C.05	Determine soil texture	Section B, Unit 1, Job Sheet 1
C.06	Interpret seed tag analysis information	Section D, Unit 2, Assignment Sheet 4
C.07	Determine tillage operation and practices	Section D, Unit 2, Assignment Sheet 3
D	**Control plant pests**	
D.01	Maintain and interpret an MSDS	Section A, Unit 2, Assignment Sheet 2
D.02	Obtain private pesticide applicator's license	

NO.	TASK	CIMC UNIT/ COMPONENT
D.03	Follow approved procedures in disposing of chemical containers	Section D, Unit 4, Job Sheet 4.
D.04	Calibrate a sprayer	Section, D, Unit 4, Job Sheet 1
D.05	Recognize symptoms of pesticide poisoning	Section A, Unit 2, Assignment Sheet 1
D.06	Use protective equipment and clothing	Section D, Unit 4, Job Sheets 2, 3, and 4
D.07	Evaluate alternative methods of pest control	Section D, Unit 4, Assignment Sheet 1
D.08	Clean pesticide equipment	Section D, Unit 4, Job Sheet 3
D.09	Calculate pesticide costs and returns	Section D, Unit 4, Assignment Sheet 5
D.10	Select appropriate pesticide	Section D, Unit 4, Assignment Sheet 3
D.11	Mix and apply pesticides	Section D, Unit 4, Job Sheet 2.
D.12	Treat plant diseases and pests	Section D, Unit 4, Assignment Sheet 1, Job Sheet 2
D.13	Recognize plant diseases and pests	Section D, Unit 4, Assignment Sheet 1
E	**Provide nutritional needs for a crop**	
E.01	Calculate fertilizer/lime cost and return	Section B, Unit 3, Assignment Sheet 1, Assignment Sheet 4, Assignment Sheet 7
E.02	Select fertilizer/lime application rates	Section B, Unit 3, Assignment Sheet 5
E.03	Recognize nutrient/pH requirements of various crops.	Section B, Unit 3, Assignment Sheet 2

NO.	TASK	CIMC UNIT/ COMPONENT
E.04	Recognize nutritional deficiencies	Section B, Unit 3, Assignment Sheet 2
E.05	Make a fertilizing schedule	Section B, Unit 3 Assignment Sheet 6
E.06	Apply soil analysis information	Section B, Unit 2, Assignment Sheet 1
E.07	Select method of applying fertilizer	Section B, Unit 3, Assignment Sheet 7
E.08	Apply fertilizer	Section B. Unit 3, Job Sheet 1
E.09	Interpret fertilizer labels	Section B, Unit 3, Assignment Sheets, 3 and 4.
E.10	Compare organic and inorganic fertilizing methods and costs	Section B, Unit 3, Assignment Sheet 7
E.11	Select appropriate cultural practices	Section D, Unit 2, Assignment Sheet 3
F	**Irrigate a crop**	
F.01	Determine economic feasibility of irrigation	Section B, Unit 3, Assignment Sheet 8
F.02	Determine water availability and quality	Section B, Unit 3, Assignment Sheet 8.
F.03	Select appropriate irrigation system	Section B, Unit 3, Assignment Sheet 8
F.04	Calculate water needs	Section B, Unit 3, Assignment Sheet 8
F.05	Maintain equipment	Agriculture Mechanics
F.06	Recognize fertigation techniques	Section B, Unit 3, Assignment Sheet 10
F.07	Determine when to irrigate	Section B, Unit 3, Assignment Sheet 9

NO.	TASK	CIMC UNIT/ COMPONENT
F.08	Determine application rate	Section B, Unit 3, Assignment Sheet 10
G	**Harvest specified crops**	
G.01	Determine when to harvest various crops	Section D, Unit 6, Assignment Sheet 3
G.02	Make marketing decisions	Farm Management
G.03	Select harvesting method	Section D, Unit 6, Assignment Sheets 1 and 2
G.04	Identify a market	Section E, Unit 1, Assignment Sheet 2
G.05	Store harvested crop	Section D, Unit 6, Assignment Sheet 4.
G.06	Operate and maintain harvesting equipment	Agriculture Mechanics

INSTRUCTOR'S GUIDE

INTRODUCTION TO SOIL, PLANT, AND CROP SCIENCE

A-1

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read the Handout *This Is Not Dinner.*

Writing

R Have students write a short (one paragraph to one page) discussion on non-agricultural uses of plants. Have students include a discussion of why they believe these uses might be important in the future.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

- **R** Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.
- **R** If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

Define soil.

- **O** Discuss the history of soil in civilizations. Have students write a short paper on the importance of soil to a particular civilization or era. Possible topics might include the Egyptians or the "Dust Bowl" of the 1930s.
- **O** Bring several different types of soil samples from your area to class for students to observe.

OBJECTIVE 2

State reasons why soil is important.

- **O** Discuss reasons why soil is important. Ask students to identify the various ways soil impacts their daily life.
- **O** Have students write a short paper stating their opinion on why it is necessary for people to be concerned about soil preservation and management.

OBJECTIVE 3

List the factors responsible for soil formation.

- **O** Discuss the factors that are responsible for soil formation. Emphasize that soils take many years to develop.

OBJECTIVE 4

Describe how plants use soil.

- Discuss how plants use soil. Bring several potted plants to class and have students observe how the plants use the soil. For example, the roots give support and the soil holds water.

OBJECTIVE 5

Describe how trends affect agricultural production.

- Discuss how trends affect agricultural production. Compare the agriculture of the United States today with that of a hundred years ago. Ask students what they think agriculture may be like in 50 years.
- Have students research and write a short paper on how agriculture in the United States has changed.
- Discuss agriculture in third world countries. Ask students if they believe agriculture trends in those countries will follow those of the United States.

OBJECTIVE 6

Identify environmental issues affecting plant agriculture.

- Discuss environmental issues affecting plant agriculture. Emphasize that some of the environmental issues, such as fertilizer pollution, are caused by agriculture, and some are caused by other factors, such as solid wastes.
- Have students research an environmental issue, such as sewage sludge (solid waste) and have them give a brief (2-3 minute) oral report to the class.
- Bring current magazines and newspapers to class or have students bring them and look for articles that deal with environmental issues that affect plant agriculture.
- Obtain OSU Extension Facts No. 2242, *Nitrates in Soil and Water*, and make it available for students to read.

OBJECTIVE 7

Describe the relationship between livestock and crop production.

- Invite a livestock rancher to discuss the relationship between livestock and crop production.
- Obtain OSU Extension Facts No. F-2586, *Wheat for Pasture*, and make it available for students to read.

OBJECTIVE 8

Describe non-agricultural uses of plants.

O Discuss non-agricultural uses of plants. Bring examples of products that use plants to class, or have students bring examples of products to class.

O Obtain OSU Current Report CR-2102, *Alternative Crop Development in Oklahoma*, and make it available for students to read.

O Obtain the books, *New Crops, New Uses, New Markets* and/or *New Crops for Food and Industry*, and make them available for students to read.

O Have students research current magazines and newspapers for articles relating to non-agricultural uses of plant. For example, the publicity given to antioxidants.

OBJECTIVE 9

Use the binomial system of plant classification.

O Discuss the binomial system of plant classification. Discuss the terms **nomenclature**, a system of names used in a branch of learning, and **taxonomy**, the science of classification.

O Inform students that there is an international set of rules which ensure that every different species has a different binomial name and that the scientific name assigned to that plant is the oldest binomial name ever used for that plant. This international set of rules is called the *International Code of Botanical Nomenclature.*

O Have students practice using the binomial system by giving them examples of the genus and species and having them write the correct scientific name on the blackboard.

OBJECTIVE 10

Complete the Assignment Sheet.

R See the general instructions for all Assignment Sheets.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.

- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.

- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.

- Describe the rating scale used on the skills test.

- Reteach and retest as necessary.

- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.

- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.

- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.

- Complete the appropriate sections of the Competency Profiles.

- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *This Is Not Dinner.* Handout.*

OPTIONAL RESOURCES

Publications

- Boone, Lester V. *Producing Farm Crops*, 4th ed. Danville, IL: Interstate Publishers, Inc., 1991.

- Johnson, Gordon V. *Nitrates in Soil and Water.* OSU Extension Facts No. 2242. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1990.

- Krenzer, Gene, Jr. *Wheat for Pasture.* OSU Extension Facts F-2586. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1994.

- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.

- *New Crops, New Uses, New Markets.* 1992 Yearbook of Agriculture. Washington, DC: U.S. Government Printing Office, 1992.
- Plaster, Edward J. *Soil Science & Management*, 2nd ed. Albany, NY: Delmar Publishers, 1992.
- Sholar, Ron and Jay C. Murray. *Alternative Crop Development in Oklahoma.* OSU Current Report CR-2102. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1988.
- Wickens, G.E., et. al. *New Crops for Food and Industry.* New York: Chapman and Hall, 1989.

UNIT REFERENCES

Publications

- Boone, Lester V. *Producing Farm Crops*, 4th ed. Danville, IL: Interstate Publishers, Inc., 1991.
- Delorit, Richard J., et. al. *Crop Production*, 5th ed. Englewood Cliffs, NJ: Prentice-Hall, 1984.
- Donahue, Roy L., et. al. *Our Soils and Their Management.* Danville, IL: Interstate Publishers, Inc., 1990.
- *Introduction to Horticulture.* Stillwater, OK: Curriculum and Instructional Materials Center, Oklahoma Department of Vocational and Technical Education, 1990.
- Miller, Raymond and Roy L. Donahue. *Soils: An Introduction to Soils and Plant Growth.* Englewood Cliffs, NJ: Prentice-Hall, 1990.
- *New Crops, New Uses, New Markets.* 1992 Yearbook of Agriculture. Washington, DC: U.S. Government Printing Office, 1992.
- Plaster, Edward J. *Soil Science & Management*, 2nd ed. Albany, NY: Delmar Publishers, 1992.
- Wickens, G.E., et. al. *New Crops for Food and Industry.* New York: Chapman and Hall, 1989.

ANSWERS

INTRODUCTION TO SOIL, PLANT, AND CROP SCIENCE

A-1

ASSIGNMENT SHEETS

OBJECTIVE 10

Assignment Sheet

Student answers will vary. Students should respond to each question.

WRITTEN TEST

OBJECTIVE 1

Soil is the combination of mineral and organic material on the earth's surface that is a natural medium for the growth of land plants.

OBJECTIVE 2

Answer should contain the following in any order:

- Soil is necessary for life and interacts with the earth's atmosphere and crust to provide life with vital resources.
- Soil is a medium for the growth of land plants.
- Agricultural uses of soil provide for the production of food, fiber, forest products, feed and grazing land for animals, and plants for exterior and interior landscaping.
- Non-agricultural uses of soil provide for recreation areas, building foundations, waste disposal, and building materials.

OBJECTIVE 3

Answer should contain the following in any order:

- Parent material
- Climate
- Biological activity
- Topography
- Time

OBJECTIVE 4

Answer should contain the following in any order:

- **Support** – Soil anchors the roots of a plant which supports the stem and leaves as they grow toward the sunlight.
- **Water** – Soil holds water which is critical for plant survival.
- **Oxygen** – Plant roots require oxygen which is held in the soil.
- **Nutrients** – The majority of the essential nutrients for plant life are available in the soil.

OBJECTIVE 5

1. The tremendous increase in world population has created pressure on agriculture to be more productive.
2. As the standard of living rises, people demand a higher quality diet; emphasis is placed on producing leaner meats, vegetables with high grade fiber and low saturated fats, etc.
3. Improved technology
4. Opportunities for bringing land into production by irrigation are offset by the use of land for commercial development.

OBJECTIVE 6

1, 3, 4, 6, 8, 9, 10, 12, 13

OBJECTIVE 7

Answer should include the following points:

- Hay and pasture crops are a vital part of the livestock industry. Livestock, such as beef cattle and dairy cattle, rely on forage for much of their nutritional needs.
- Crops may serve as both forage and grain.
- Crops may serve as both pasture and hay.
- Price variations in hay will have financial and management effects on the livestock producer.

OBJECTIVE 8

1. Answer should include three uses from the following:
    - Seed oils from traditional crops such as soybeans, corn, cotton, coconuts, and flax provide raw materials for many of our everyday products such as soap and grease for lubricating automobiles.
    - Oils from new crops, such as crambe and rapeseed, produce oils that are used in products such as lubricants, plastics, and cosmetics.
    - The fatty acids of soybean oil and tall oil (from wood) are used in glue products; fatty acids in coconut oil are used in soaps and detergents. Other uses of fatty acids include fabric softeners, cosmetics, plastics, paints, coatings, and inks.
    - Essential oils are used in fragrances, flavor applications, and medicine.
    - The paint and coatings industry uses starches as stabilizers and flow modifiers in latex paints.
    - Starches are used in adhesive products.
    - Starches are used as a binder in explosives and also in the textile industry to size textiles.
    - Modified starches are used extensively in the paper industry.

- Starch-derived materials, which are biodegradable, are primary candidates to replace nondegradable petroleum-derived plastics.

- Lignocellulose materials are used in the wood and paper pulp industry.

- Lignocellulose materials can provide raw materials identical to those now used in the petrochemical industry.

2. Answer should include one use from the following:

    - Plant products may be used as chemotherapeutic agents and as cancer prevention agents.

    - Plant products are used in many medicines.

3. Answer should include the following:

    ☐ Biofuels, materials that are biological in nature and used to produce energy, can provide fuel for transportation and help reduce air pollution from traditional fossil fuels.

OBJECTIVE 9

1. Triticum
2. Trifolium
3. durum
4. *Prunus persica*

OBJECTIVE 10

Evaluated on the Assignment Sheet.

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE – A-1 Introduction to Soil, Plant, and Crop Science

TOTAL NUMBER OF TEST QUESTIONS 41

TOTAL NUMBER OF BASIC SKILL QUESTIONS 16

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1	X
2	1-4	X
3	1-6	X
4	1-4	S
5	1-4	W
6	1-14	X
7	1	W
8	1-3	W
9	1-4	S
10	Evaluated on AS	

INSTRUCTOR'S GUIDE

SAFETY

A-2

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read OSU Fact Sheet No. F-9417, *Combine Operations: Safety* or OSU Fact Sheet No. F-9420, *Tractor Upsets – Cause and Prevention.*

Writing

R Have students write a short essay (one page) on the importance of following safety precautions mentioned in the fact sheet which they choose. Have students include a discussion of what may happen if proper safety procedures are not followed.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

Describe the purpose of a Material Safety Data Sheet.

O Obtain copies of Material Safety Data Sheets that list chemicals used in agriculture. Ask students questions over the MSDSs.

O Obtain a copy of *29 CFR (Code of Federal Regulations) 1910.1200 Hazard Communication Standard* and make it available for students to look at. Discuss the fact that there are both state and federal regulations which must be followed when working with hazardous materials.

O Have students compile a list of resources and phone numbers for assisting them in gathering information regarding hazardous wastes.

☑ **NOTE:** Resources that list this information include Oklahoma State University Publication E-832, *Annual Extension Agent's Handbook of Insect, Plant Disease and Weed Control* and *Hazardous Waste Management for the Small Quantity Generator* (CIMC). Students may also find information by researching or interviewing.

O Obtain a copy of the *Oklahoma Hazard Communication Standard* and make it available for students to read. Discuss the Standard with students.

O Obtain current OSHA publications and fact sheets. For a listing of publications write: OSHA Publication Distribution, Room S-4203, Washington, DC 20210.

OBJECTIVE 2 **Define acute and chronic toxicity.**

OBJECTIVE 3 **Define oral, dermal, and inhalation toxicity.**

OBJECTIVE 4 **List symptoms of pesticide poisoning.**

- Obtain a copy of OSU Extension Facts No. 7457, *Toxicity of Pesticides* and make it available for students to read.
- Obtain a copy of OSU Publication E-834, *Applying Pesticides Correctly* and refer to the section on Pesticide Safety. Make the publication available for students to read.
- Obtain a copy of OSU Extension Facts No. 7453, *First Aid for Pesticide Poisoning* and make it available for students to read.
- Have a medical professional speak to the class about symptoms of pesticide poisoning.

OBJECTIVE 5 **Choose the word or phrase to complete statements about chemical safety precautions.**

- Consult with your local school administration before allowing students to handle any substances which may pose hazards. Although there is currently no age restriction on using pesticides, child labor laws may apply to handling dangerous or hazardous substances.
- Obtain a copy of OSU Publication E-834, *Applying Pesticides Correctly* and refer to the section on Pesticide Safety. Make the publication available for students to read.
- Obtain a copy of OSU Extension Facts F-1012, *Pesticide and Fertilizer Facility Operations Checklist* and make it available for students to read.
- Obtain a copy of OSU Extension Facts F-1723, *Anhydrous Ammonia Safety* and make it available for students to read.
- For information about agricultural safety and health, contact:

Project Director
Oklahoma Agricultural Health Promotion System
Department of Biosystems and Agricultural Engineering
Oklahoma State University
Stillwater, OK 74078
(405) 744-5427

The National Institute for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226
(800) 356-4674

OBJECTIVE 6

Complete statements about the importance of protective clothing and equipment.

- Obtain a copy of OSU Publication E-834, *Applying Pesticides Correctly* and refer to the section on Pesticide Safety. Make the publication available for students to read.
- Bring examples of protective clothing and equipment to class for students to examine.

OBJECTIVE 7

Select from a list true statements concerning chemical storage.

- Obtain a copy of OSU Extension Facts No. 7451, *Agricultural Pesticide Storage* and make it available for students to read.
- Obtain a copy of OSU publication E-834, *Applying Pesticides Correctly* and refer to the section on Pesticide Safety. Make the publication available for students to read.

OBJECTIVE 8

Choose correct methods of hazardous waste disposal.

- Obtain a copy of OSU publication E-834, *Applying Pesticides Correctly* and refer to the section on Pesticide Safety. Make the publication available for students to read.

OBJECTIVE 9

Discuss labeling of hazardous materials.

- Obtain a copy of OSU publication E-834, *Applying Pesticides Correctly* and refer to the section on Labels and Labeling. Make the publication available for students to read.
- Bring examples of pesticide labels to class. Go over the information on the labels with students.
- Review the different hazard warning systems.

OBJECTIVE 10

Choose the word or phrase to complete statements about chemical use and groundwater protection.

- Obtain OSU Extension Facts No. F-2242, *Nitrates in Soil and Water* and make it available for students to read.
- Obtain OSU Publication E-891, *Water Quality and Agriculture's Role for the Future* and make it available for students to read.

- Obtain OSU Extension Facts No. F-1512, *Groundwater Quality and Treatment* and make it available for students to read.
- Obtain OSU Extension Facts No. F-7459, *Pesticides in Ground Water* and make it available for students to read.
- Have students write a report on the problem of groundwater contamination. Have students give a brief (2-3 minute) report on their findings to the class.

OBJECTIVE 11 **List hand tool safety precautions and procedures.**

OBJECTIVE 12 **List power tool safety precautions and procedures.**

- Have the shop instructor speak to the class about hand tool and power tool safety precautions and procedures.
- Bring examples of hand tools and power tools to class. Point out features on the tools that may make them hazardous if proper safety precautions and procedures are not followed. For example, sharp edges or guards.
- Obtain safety posters and safety information from the National Safety Council, 444 North Michigan Avenue, Chicago, IL 60611, phone 1-800-621-7619.
- Write short scenarios of accidents occurring with equipment. Have students determine what could have been done to prevent the accident.

OBJECTIVE 13 **Complete statements concerning safety around large equipment.**

- Obtain OSU Extension Facts F-1727, *Machinery Safety on the Farm* and make it available for students to read.
- Obtain OSU Publication CR-1726, *Grain Bin Entrapment: What If It Happens to You?* and make it available for students to read.
- Ask students who may work around large equipment what special safety precautions they take.
- Have students interview a farmer or rancher about safety around large equipment. Have the students write a short report over the interview.

OBJECTIVE 14

Pass a chemical safety test with a score of 100%. (Assignment Sheet 1)

R See the general instructions for all Assignment Sheets.

R If students do not score 100%, have them retake the safety test.

OBJECTIVE 15

Interpret an MSDS. (Assignment Sheet 2)

R See the general instructions for all Assignment Sheets.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.
- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.
- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.
- Describe the rating scale used on the skills test.
- Reteach and retest as necessary.
- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.
- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.
- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.
- Complete the appropriate sections of the Competency Profiles.
- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Combine Operations: Safety.* OSU Extension Facts No. F-9417. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Tractor Upsets — Cause and Prevention.* OSU Extension Facts No. F-9420. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

OPTIONAL RESOURCES

Publications

- *Agricultural Pesticide Storage*, OSU Extension Facts No. 7451. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Anhydrous Ammonia Safety*, OSU Extension Facts No. F-1723. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Applying Pesticides Correctly*, Circular E-834. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1988.
- *First Aid for Pesticide Poisoning*, OSU Extension Facts No. 7453. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Grain Bin Entrapment: What If It Happens to You?* OSU Current Report 1726. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Groundwater Quality and Treatment*, OSU Extension Facts No. F-1512. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Hazardous Waste Management for the Small Quantity Generator*. Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1989.
- *Machinery Safety on the Farm*, OSU Extension Facts No. F-1727. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach*. Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.
- *Nitrates in Soil and Water*, OSU Extension Facts No. F-2242. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

- *OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control*, Circular E-832 (most current edition). Stillwater, OK: Oklahoma State University Cooperative Extension Service.

- *Pesticide and Fertilizer Facility Operations Checklist*, OSU Extension Facts No. F-1012. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

- *Pesticide Recordkeeping Requirements for Crop Production*, OSU Extension Facts No. 322. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

- *Pesticides in Ground Water*, OSU Extension Facts No. F-7459. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

- *Safety on the Job*. Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1989.

- *Toxicity of Pesticides*, OSU Extension Facts No. 7457. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

- *Water Quality and Agriculture's Role for the Future*, OSU Publication E-891. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

☑ **NOTE:** For information on Oklahoma State University Cooperative Extension publications contact your local County Extension Agent.

UNIT REFERENCES

Publications

- *Agricultural Pesticide Storage*, OSU Extension Facts No. 7451. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

- *Agricultural Sales and Service*. Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1990.

- *Applying Pesticides Correctly*, Circular E-834. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1988.

- *Crop Chemicals.* Moline, IL: John Deere, 1982.
- *Hazard Communication Training.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1994.
- *Hazardous Waste Management for the Small Quantity Generator.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1989.
- *Machinery Safety on the Farm*, OSU Extension Facts No. F-1727. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Pesticide and Fertilizer Facility Operations Checklist*, OSU Extension Facts No. F-1012. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Safety on the Job.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1989.
- *Toxicity of Pesticides*, OSU Extension Facts No. 7457. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *1994 OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control*, Circular E-832. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1994.

ASSIGNMENT SHEETS

OBJECTIVE 14

Assignment Sheet 1

1. F
2. T
3. F
4. T
5. T
6. F
7. F
8. T
9. F
10. F
11. F
12. T
13. F
14. F
15. T
16. T
17. F
18. T
19. F
20. F
21. T
22. F
23. T
24. F
25. F
26. F
27. T
28. T
29. T
30. F

OBJECTIVE 15

Assignment Sheet 2

1. 800-331-3148
2. Command® 4 EC Herbicide, Command® 480 g/L EC Herbicide
3. Clomazone
4. Straw yellow liquid with an aromatic solvent odor
5. Moderately combustible
6. Decreased activity, tearing eyes, bleeding from the nose, and incoordination
7. Eyes – Flush with water for at least 15 minutes. If irritation occurs and persists, contact a medical doctor.
   Ingestion – Rinse mouth with water. Dilute by giving 1 or 2 glasses of water. Do not induce vomiting. Never give anything by mouth to an unconscious person. See a medical doctor immediately.

8. Eye protection – For splash, mist or vapor exposure, wear chemical protective goggles or a face shield.
   Gloves – Wear chemical protective gloves made of materials such as neoprene.
9. Ranges from highly to moderately toxic
10. Excessive heat and fire

WRITTEN TEST

OBJECTIVE 1

Answer should contain key points from the following:

- The Material Safety Data Sheet (MSDS) supplies information about the characteristics of the hazardous chemical, the physical and health hazards associated with the chemical, precautions for safe handling and use of the chemical, and other information.
- The MSDS is used to find out about the physical and health hazards of working with the chemical before you work with it. The MSDS will tell you how to handle and use the hazardous chemical safely.

OBJECTIVE 2

1. **Acute toxicity** results from a single incident of exposure to a substance.
2. **Chronic toxicity** results from repeated exposure to pesticides over a period of time.

OBJECTIVE 3

1. **Oral toxicity (swallowing)** – toxicity which occurs when hazardous substances enter through the mouth
2. **Dermal toxicity (contact with skin)** – toxicity which occurs when hazardous substances enter through the skin and eyes (skin contamination)
3. **Inhalation toxicity (breathing)** – toxicity which occurs when hazardous substances enter through the lungs

OBJECTIVE 4

Answer should include any ten of the following:

- Redness, blisters, or a rash on the skin
- Irritating sensations or swelling in the eyes, nose, mouth, or throat
- Headaches
- Dizziness
- Weakness
- Nausea
- Stomach cramps
- Diarrhea
- Sweating
- Shaking
- Excitability
- Disorientation
- Excessive sweating
- Vomiting
- Thirst
- Convulsions
- Irritation of the lungs
- Lack of coordination
- Discoloration of urine/blood in the urine
- Garlic odor on breath
- Chills
- Cough
- Discolored skin
- Shortness of breath
- Shock
- Muscle twitching
- Salivation

OBJECTIVE 5

1. B
2. C
3. A
4. C
5. D
6. A
7. B
8. D
9. A
10. B

OBJECTIVE 6

1. long-sleeved, long-legged
2. goggles, face shield
3. chemical-resistant
4. water-repellent
5. prevent
6. gloves
7. label

OBJECTIVE 7

1, 2, 3, 5, 6, 8, 10, 11, 12, 13, 15, 16, 17, 19

OBJECTIVE 8

1. C
2. A
3. D
4. C

OBJECTIVE 9

1. Answer should include any two of the following:
    - Required by law
    - Identifies containers of hazardous chemicals
    - Warns about the hazards of a hazardous chemical
    - Gives the name and address of the responsible party

2. The identity of the hazardous chemicals in the container and appropriate hazard warnings.

3. English

4. They should be replaced.

5. All applicable standards and OSHA guidelines.

OBJECTIVE 10

1. B
2. D
3. A
4. C
5. B

OBJECTIVE 11

Answer should include any eight of the following:

- Use the right tool for the job.
- Keep sharp tools sharp.
- Keep tools clean.
- Inspect tools often and repair or replace damaged or broken tools before using them again.
- Pay attention at all times.
- Wear the right kind of personal protective equipment, when needed.
- Store all tools properly when not in use.
- Use appropriate tool boxes, tool chests, and cabinets for storage.
- While you are using tools, store them properly.
- Guard the sharp edges of tools in storage and on-the-job.

OBJECTIVE 12

Answer should include eight of the following:

- Use the right tool for the job.
- Know how to use the tool correctly before using any power tool.
- Ground all power tools before using them.
- Replace any damaged or worn parts and power cords before using a tool.
- Make sure all equipment is in OFF position before plugging in the equipment.
- Remove keys and adjusting wrenches before starting the tool.
- Wear the proper type of protective clothing and equipment.
- Keep your hands and clothing away from any moving parts of the tool at all times.
- Do not use a power tool on or near a wet surface.
- Turn off and unplug the tool before adjusting the tool or changing any attachments.
- Store the tool properly after using it.
- Never leave a running tool unattended.
- Remove any jewelry before using a power tool.

OBJECTIVE 13

1. manufacturer's
2. Shut off
3. power takeoff drive lines
4. Inspect
5. hazards
6. catch
7. equipment
8. operate

OBJECTIVE 14

Evaluated on Assignment Sheet 1.

OBJECTIVE 15

Evaluated on Assignment Sheet 2.

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE – **A-2 Safety**

TOTAL NUMBER OF TEST QUESTIONS **90**

TOTAL NUMBER OF BASIC SKILL QUESTIONS **21**

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1	W
2	1-2	X
3	1-3	X
4	1-10	X
5	1-10	S
6	1-7	X
7	1-19	X
8	1-4	X
9	1-5	W
10	1-5	S
11	1-8	X
12	1-8	X
13	1-8	X
14	Evaluated on AS 1	
15	Evaluated on AS 2	

INSTRUCTOR'S GUIDE

CAREERS

A-3

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read the Handout *Careers in Crop Science.*

Writing

R Have students write a short (one paragraph to one page) essay describing what they believe would be advantages and disadvantages to the three jobs described.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

Discuss employment opportunities at various educational levels.

O Invite a career counselor to discuss career selection with the class.

O Have students complete an interest inventory.

O Show one or more videos on careers (see Optional Resources).

O Have students use a computer data base program such as *Career Search* to research educational requirements for various careers in crop science.

OBJECTIVE 2

Compare degree requirements in crop science from two colleges or universities. (Assignment Sheet 1)

R See the general instructions for all Assignment Sheets.

R Provide students with two college catalogs that offer degrees in crop science. Refer to Handout 2 for a list of colleges and universities in Oklahoma and surrounding states that offer degrees in crop science.

☑ **NOTE:** For a more comprehensive listing of colleges and universities refer to the publications *Exploring Careers in Agronomy, Crops, and Soils*; and *Our Soils and Their Management.*

O Obtain the publications *Exploring Careers in Agronomy, Crops, and Soils* and *Challenging Careers in Soil Conservation* and make them available for students to read.

OBJECTIVE 3 **Compare salaries and benefits in various careers. (Assignment Sheet 2)**

R See the general instructions for all Assignment Sheets.

OBJECTIVE 4 **Determine areas of study/specialization in crop science.**

O Invite individuals to discuss their crop science careers.

O Show the videos that focus on areas of study/specialization in crop science (see Optional Resources).

OBJECTIVE 5 **Evaluate requirements for a career in crop science.**

O Emphasize to students that they must also have the necessary skills to *acquire* a job. Have students read the *Skills For Employment* series from the Oklahoma State University Cooperative Extension Service (see Optional Resources).

O Show the videos which focus on obtaining employment (see Optional Resources).

OBJECTIVE 6 **Interview someone in the crop science industry. (Assignment Sheet 3)**

R See the general instructions for all Assignment Sheets.

R Approve each student's choice for an individual to interview. You may choose to have one or more resource individuals speak to the entire class instead of having students conduct personal interviews.

R Approve each student's list of ten (or more) interview questions.

R Approve each student's thank-you letter or have the entire class send a thank-you letter to the class speaker.

OBJECTIVE 7 **Name organizations that employ people trained in crop science.**

O Have students write a letter to a public or private organization requesting information about job opportunities or general information about the organization.

O Show the videos that focus on different careers (see Optional Resources).

OBJECTIVE 8

Identify organizations involved in production, sales, or services of crops in your community, county, or area. (Assignment Sheet 4)

R See the general instructions for all Assignment Sheets.

R Provide copies of the local yellow pages. If you live in a rural community you may wish to obtain copies of the yellow pages of the surrounding areas if they also provide organizations that support crop science in your area.

OBJECTIVE 9

Outline a presentation on crop science careers. (Assignment Sheet 5)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 10

Give a presentation on a career in crop science. (Assignment Sheet 6)

R See the general instructions for all Assignment Sheets.

O Review presentation skills.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.

- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.

- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.

- Describe the rating scale used on the skills test.

- Reteach and retest as necessary.

- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.

- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.

- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.

- Complete the appropriate sections of the Competency Profiles.

- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Careers in Crop Science.* Handout 1.*
- *Colleges and Universities.* Handout 2.*

OPTIONAL RESOURCES

Publications

- *Exploring Careers in Agronomy, Crops, and Soils.* For ordering information contact:

  American Society of Agronomy, Crop Science Society of
  America, Soil Science Society of America
  677 South Segoe Road
  Madison, WI 53711
  (608) 273-8080
  FAX (608) 273-2021

- *Challenging Careers in Soil Conservation.* United States Department of Agriculture, Soil Conservation Service. To obtain this publication contact your local conservation district office.
- Donahue, Roy L., et. al. *Our Soils and Their Management*, 6th ed. Danville, IL: Interstate Publishers, Inc., 1990.
- Publications available from CIMC. For ordering information call 800-522-5810.
  - ☐ *Career Development Activity Books*
  - ☐ *Pathfinder: Exploring Career and Educational Paths*
  - ☐ *The Complete Guide for Occupational Exploration*
  - ☐ *Occupational Clues*
  - ☐ *The Occupational Outlook Handbook*
  - ☐ *The Enhanced Guide for Occupational Exploration*
  - ☐ *Dream Catchers*
  - ☐ *Employment Skills for the 21st Century*
  - ☐ *Critical Steps of Job Interviewing*

- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.
- Publications available from the Oklahoma State University Cooperative Extension Service:
  - ☐ T-6102, *Skills For Employment: Assessing Job Skills*
  - ☐ T-6103, *Skills For Employment: Writing a Resume*
  - ☐ T-6104, *Skills For Employment: The Job Search*
  - ☐ T-6105, *Skills For Employment: The Job Application*
  - ☐ T-6106, *Skills For Employment: The Job Interview*
  - ☐ T-6107, *Skills For Employment: Accepting and Starting the Job*

Videos

- Videos available from CIMC. For ordering information call 800-522-5810.
  - ☐ *Careers for the 21st Century, Vol. I*
    - Program 10: *Educator*
  - ☐ *Careers for the 21st Century, Vol. II*
    - Program 1: *Teacher*
    - Program 5: *Researcher*
    - Program 11: *Dietitian*
  - ☐ *Careers for the 21st Century, Vol. III*
    - Program 3: *Biotechnology*
    - Program 5: *Environmental Engineer*
    - Program 11: *Chemist, Purchasing Agent*
    - Program 12: *Agribusiness*

- The following are from Creative Educational Videos, Lubbock, TX. These videos are available through CIMC. For ordering information call 800-522-5810.

  - ☐ *Practice Interview I*
  - ☐ *Practice Interview II*
  - ☐ *Getting in the Door*
  - ☐ *Resumes*
  - ☐ *Careers: The Right Fit*
  - ☐ *Careers: Marketing Yourself*
  - ☐ *Profile of the Perfect Employee*
  - ☐ *STAR: Job Interview*
  - ☐ *Prepared Speech*

  ☑ **NOTE:** The following videos include employment opportunities, necessary skills/degree required, average salaries, and interviews with people working in the field.

  - ☐ *Careers in Plant and Soil*
  - ☐ *Marketing Specialists*
  - ☐ *Agricultural Producers*
  - ☐ *Social Service Professionals*
  - ☐ *Agricultural Scientists*
  - ☐ *Financial Specialists and Managers*
  - ☐ *Education and Communication Specialists*

- The following videos are available from the Oklahoma State University Cooperative Extension Service. Stillwater, OK.

  - ☐ VT280, *Ag's New Professionals*
  - ☐ VT291, *Futures in Agriculture*

UNIT REFERENCES

Computer Software

- *Career Search.* Stillwater, OK: Oklahoma Department of Vocational and Technical Education, 1994. For ordering information call 800-522-5810.

Other Media

- Agriculture Careers Kit, NASCO Agricultural Sciences Catalog. Nasco-Fort Atkinson, 901 Janesville Ave, P.O. Box 901, Fort Atkinson, WI 53538-0901, phone 800-558-9595, FAX 414-563-8296.

Publications

- *Introduction to Agricultural Sales and Service.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1990.
- *Animal Science.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1995.
- Donahue, Roy L., et al. *Our Soils and Their Management.* Danville, IL: Interstate Publishers, Inc., 1990.
- Donahue, Roy L. and James E. Christiansen. *Exploring Agriculture*, 6th ed. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1984.
- *Forestry.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1991.

ASSIGNMENT SHEETS

OBJECTIVE 2	**Assignment Sheet 1** Student answers will vary. Students should compare two degree requirements. The essay should contain correct grammar, punctuation, and spelling.
OBJECTIVE 3	**Assignment Sheet 2** Student answers will vary. Students should compare two occupations for each educational level.
OBJECTIVE 6	**Assignment Sheet 3** Students answers will vary. Students should complete Parts 1-3 of the assignment.
OBJECTIVE 8	**Assignment Sheet 4** Student answers will vary. Students should identify at least one organization in each category.
OBJECTIVE 9	**Assignment Sheet 5** Student answers will vary.
OBJECTIVE 10	**Assignment Sheet 6** Answers will vary. Refer to the Assignment Sheet for criteria in evaluating the speech.

WRITTEN TEST

OBJECTIVE 1

1. Answers should contain the following:
    - Obtain related experience through clubs and organizations.
    - Have work experience.
    - Know how to use computers.
    - Assess your interests and skills.
2. Four-year college degree
3. Enables you to enter a profession at a higher level than with a high school education. There is greater possibility for advancement.
4. Advanced college degree
5. Enables you to learn basic skills on the job in an entry level position.

OBJECTIVE 2

Evaluated on Assignment Sheet 1.

OBJECTIVE 3

Evaluated on Assignment Sheet 2.

OBJECTIVE 4

1. G
2. A
3. C
4. K
5. J
6. E
7. I
8. H

OBJECTIVE 5

1. Formal education (classroom) and skills learned during on-the-job training
2. Communications and human relations skills
3. Being on time every day to the job, observing safety practices, and being able to take responsibility
4. Acting appropriately, dressing appropriately, using appropriate language, and following ethical business practices

OBJECTIVE 6

Evaluated on Assignment Sheet 3.

OBJECTIVE 7

Answer should include the following:

- Federal agencies
- State agencies
- Educational institutions
- Lobbyists and promotional organizations
- Public and private businesses and institutions

OBJECTIVES 8-10

Evaluated on Assignment Sheets 4-6.

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE – A-3 Careers

TOTAL NUMBER OF TEST QUESTIONS 22

TOTAL NUMBER OF BASIC SKILL QUESTIONS 17

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-5	E
2	Evaluated on AS 1	
3	Evaluated on AS 2	
4	1-8	E
5	1-4	E
6	Evaluated on AS 3	
7	1-5	X
8	Evaluated on AS 4	
9	Evaluated on AS 5	
10	Evaluated on AS 6	

INSTRUCTOR'S GUIDE

SOILS

B-1

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read OSU Fact Sheet No. F-2207, *How To Get a Good Soil Sample* or F-2227, *Using Soil Data in Community Planning.*

Writing

R Have students write a short (one paragraph) essay of the information contained in the publication. Have students include a discussion on why knowledge of soil science is important for the particular use in the publication.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

Describe the components of a soil survey report.

O Visit your local conservation district office and obtain educational information on soils, a local soil survey report, and information on guest speakers.

O Discuss the components of a soil survey report.

O Bring samples of soil survey reports to class for students to examine. Ask students questions about the reports.

O Obtain the most current and detailed soil survey for your location. Visit one of the areas on the map and compare the area to the soil survey.

OBJECTIVE 2

List the uses of a soil survey report.

O Discuss the uses of a soil survey report. Invite a local county extension agent or conservation district employee that is knowledgeable about soil surveys and their uses to speak to the class.

O Obtain the publications *Soil Surveys Can Help You; Farmers & Ranchers...Soil Surveys Can Help You; Land Use Planners...Soil Surveys Can Help You; Construction Engineers...Soil Surveys Can Help You*; and *Assistance Available from the Soil Conservation Service* and make them available for students to read.

OBJECTIVE 3

Name groups of people who benefit most from a soil survey report.

O Discuss groups of people who benefit from a soil survey report. Ask students how these groups might benefit from a soil survey report.

OBJECTIVE 4

Describe the types of soil water.

O Have students observe the effects of soil water on plants by growing three plants, such as tomato plants, in separate pots until each has several leaves. Have the students water the plants differently; for example, water one plant so that the soil is always wet; water another group when the soil surface dries; and the third group when the plant wilts. Have students record and observe differences in the plant growth.

O Discuss ways to measure the amount of water in soil.

OBJECTIVE 5

Select from a list the primary, secondary, and micronutrients found in soil.

O Discuss the primary, secondary, and micronutrients found in soil. Explain that knowing how plants use these nutrients helps to understand how best to use fertilizers for plant growth.

O Review the symbols for each of the essential elements.

OBJECTIVE 6

Describe the soil textures.

R Show the Transparency Master to illustrate the soil triangle.

O Discuss the soil textures. Emphasize that soils usually consist of more than one soil separate.

O Give students examples of the percentages of separates in soils and have them use the textural triangle to determine the textural class. An example would be a soil that is 40% sand, 20% clay, and 40% silt would be a loam. To identify the soil, a line is drawn from each percentage point; the spot where the three lines meet is the soil texture.

OBJECTIVE 7

Match soil structures to their definitions.

O Bring examples of different soil structures to class for students to examine.

OBJECTIVE 8

Describe the horizons of a soil profile.

O Obtain samples of rocks and minerals which form soils such as sandstone, limestone, shale, quartz, gypsum, dolomite, mica, etc. Use a field guide to rocks and minerals and have students look up information on the rocks and minerals.

O Discuss degrees of soil depth. The degrees are shown below:

- Deep – soil that is more than 40 inches deep
- Moderately deep – soil that is 20 to 40 inches deep
- Shallow – soil that is 10 to 20 inches deep
- Very shallow – soil that is less than 10 inches deep

OBJECTIVE 9

Identify soil classification using a soil survey. (Assignment Sheet)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 10

Determine soil texture by touch. (Job Sheet 1)

R See the general instructions for all Job Sheets.

R Show the appropriate portions of the video *Land Judging*.

OBJECTIVE 11

Perform a soil profile examination. (Job Sheet 2)

R See the general instructions for all Job Sheets.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.

- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.

- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.

- Describe the rating scale used on the skills test.

- Reteach and retest as necessary.

- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.

- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.

- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.

- Complete the appropriate sections of the Competency Profiles.
- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *How To Get a Good Soil Sample*. OSU Fact Sheet No. F-2207. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Using Soil Data in Community Planning*. OSU Fact Sheet No. F-2227. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- Samples of soil surveys

☑ **NOTE:** Contact your local conservation district for information on obtaining a soil survey.

Videos

- *Land Judging*. Lubbock, TX: Creative Educational Video. This video is available through CIMC, Oklahoma Department of Vocational and Technical Education. For ordering information call 800-522-5810.

OPTIONAL RESOURCES

Publications

- Boone, Lester V. *Producing Farm Crops*. Danville, IL: Interstate Publishers, Inc., 1991.
- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach*. Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.
- Miller, Raymond W. and Roy L. Donahue. *Soils: An Introduction To Soils and Plant Growth*, 6th ed. Englewood Cliffs, NJ: Prentice Hall, 1990.

- Plaster, Edward J. *Soil Science & Management*, 2nd ed. Albany, NY: Delmar Publishers, Inc., 1992.
- Natural Resources Conservation Service publications:
  - *Soil Surveys Can Help You*
  - *Farmers & Ranchers...Soil Surveys Can Help You*
  - *Land Use Planners...Soil Surveys Can Help You*
  - *Construction Engineers...Soil Surveys Can Help You*
  - *Assistance Available from the Soil Conservation Service*

  ☑ **NOTE:** Natural Resources Conservation Service publications may be obtained through your local conservation district office.

UNIT REFERENCES

Publications

- Boone, Lester V. *Producing Farm Crops*. Danville, IL: Interstate Publishers, Inc., 1991.
- Donahue, Roy L., Roy Hunter Follett, and Rodney W. Tulloch. *Our Soils and Their Management*. Danville, IL: Interstate Publishers, 1990.
- Gougler, Doyle. *Agricultural Style Manual and Glossary*. College Station, TX: AgStyle, 1987.
- Miller, Raymond W. and Roy L. Donahue. *Soils: An Introduction To Soils and Plant Growth*, 6th ed. Englewood Cliffs, NJ: Prentice Hall, 1990.
- Plaster, Edward J. *Soil Science & Management*, 2nd ed. Albany, NY: Delmar Publishers, Inc., 1992.
- Wiseman, A., H. Finch, and A.M. Samuel. *Lockhart & Wiseman's Crop Husbandry*, 7th ed. New York: Permagom Press, 1993.

ASSIGNMENT SHEET

OBJECTIVE 9

Assignment Sheet

Student answers will vary depending upon the soil surveys used.

WRITTEN TEST

OBJECTIVE 1

Answer should include the following:

- Set of soil maps – soil maps can cover large areas, such as states or regions; more detailed maps cover areas such as counties; farm maps cover areas used by individual farmers
- Map legends which explain symbols used on the maps – map symbols give information about items such as slope, erosion, and landscape features
- Descriptions of the soils – includes information on the taxonomy of the soil, a brief description of the soil, and soil properties of each horizon
- Use and management reports for the soils – information on the appropriate uses of the soil such as for crops and pastures, woodlands, recreation, wildlife habitat, and engineering projects

OBJECTIVE 2

Answer should include the following:

- Aid in land-use management and planning
- Planning for civil and industrial projects
- Help in determining building sites
- Help in choosing new land for growing crops
- Help in planning irrigation and other engineering projects
- Provides information regarding yields of principal crops
- Used in preparing field maps
- Provides the basic soil characteristics that are used to place soils into land capability classes
- Helps in determining the value of the land for agricultural uses

OBJECTIVE 3

Answer should include the following:

- Farm Service Agency
- Banks, land appraisers, and tax assessors
- Engineers (highway and others)
- Farmers, ranchers, and farm managers
- Planning boards, health officials, and municipal officials
- Natural Resources Conservation Service
- Agricultural education teachers and county extension agents
- Wildlife and recreational departments

OBJECTIVE 4

Answer should include the following:

1. **Saturation** – all soil pores are completely filled with water
2. **Field capacity** – maximum amount of water left in the soil after drainage ceases and no surface evaporation has occurred
3. **Wilting point** – the point at which plants cannot obtain enough water to supply their transpiration needs

OBJECTIVE 5

2, 4, 5, 7, 8, 9, 11, 12, 13, 15, 17, 18, 20

OBJECTIVE 6

Answer should include the following in any order:

- **Sand** – sandy soils have particles which are finer than gravel soils but are coarse enough for each individual particle to be visible; sandy soils are open and have good drainage; sandy soils are good for vegetable and other early season crops if sufficient water is available
- **Silt** – silt particles are smaller than sand particles and cannot be seen; silt particles feel silky or powdery; silt particles are intermediate in size between sand and clay particles and are important elements in loam soils
- **Clay** – clay particles are the smallest-sized individual particles; clay particles stick together and so are not individual grains in the soil; clay soils have high water-holding capacity; clay soils generally tend to be fertile and retain plant nutrients

OBJECTIVE 7

1. I
2. E
3. K
4. C
5. L
6. D
7. A
8. H

OBJECTIVE 8

Answer should include the following:

1. **O Horizon** – an organic layer of fresh and decaying plant and animal residue at the surface of a mineral soil
2. **A Horizon** – the surface mineral layer where organic matter accumulates; often called topsoil, provides the best environment for the growth of plant roots, microorganisms, and other life
3. **E Horizon** – the zone of greatest eluviation; the E horizon is very leached of clay, chemicals, and organic matter
4. **B Horizon** – usually referred to as the subsoil, the zone where chemicals leached out of the A horizon accumulate; the B horizon has a lower organic matter content than the A horizon and often has more clay
5. **C Horizon** – the layer that is little affected by the soil-forming processes; the C horizon does not have the properties of the A and B horizons; usually the parent material of the soil
6. **R Horizon** – the underlying bedrock beneath the soil

OBJECTIVE 9

Evaluated on the Assignment Sheet.

OBJECTIVE 10

Evaluated on Job Sheet 1.

OBJECTIVE 11

Evaluated on Job Sheet 2.

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE – **B-1 Soils**

TOTAL NUMBER OF TEST QUESTIONS **61**

TOTAL NUMBER OF BASIC SKILL QUESTIONS **36**

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-4	W
2	1-9	X
3	1-8	X
4	1-3	W, S
5	1-20	S
6	1-3	W
7	1-8	X
8	1-6	W, S
9	Evaluated on AS	
10	Evaluated on JS 1	
11	Evaluated on JS 2	

INSTRUCTOR'S GUIDE

SOIL SAMPLING

B-2

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read *Causes and Effects of Soil Acidity*, OSU Extension Facts No. 2239.

Writing

R Have students write a short essay (one page) on the causes of soil acidity. Have the students include a brief discussion of why soil acidity is of concern to farmers and what can be done to correct the problem.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

List reasons for testing soil.

O Discuss reasons for testing soil. Invite a local County Extension Agent to speak to the class about soil testing.

OBJECTIVE 2

Name the major items for which soils are tested.

O Obtain *OSU Soil Test Interpretations*, OSU Extension Facts No. 2225 and make it available for students to read.

O Review the chemical symbols of the elements.

O Have students refer to agricultural textbooks and review the sections on the nutrients plants receive from soils.

OBJECTIVE 3

Label a soil pH scale.

O Obtain *Soil pH and Buffer Index*, OSU Extension Facts No. 2229 and make it available for students to read.

O Have students research specific plants and determine soil pH ranges which are suitable to the plants. For example, students may find out the pH preference of legumes and non-legumes, certain vegetables or fruit trees, etc.

OBJECTIVE 4

Select from a list areas from which soil samples should not be taken.

O Discuss areas from which soil samples should not be taken. Bring several samples of soil taken from these areas and also soil from acceptable test areas. Have students examine the samples and determine if they can visually notice any difference in the samples.

OBJECTIVE 5

Identify tools used to collect soil samples.

O Bring examples of the tools to class and let students examine them.

O Demonstrate to students the proper way to use the tools.

OBJECTIVE 6

List the steps for collecting a soil sample.

O Obtain *How to Get a Good Soil Sample*, OSU Extension Facts No. 2207 and make it available for students to read.

O Emphasize that the instructions of the testing laboratory should always be followed.

OBJECTIVE 7

Name locations in Oklahoma where soil samples can be sent for testing.

O Emphasize that the soil samples sent to a lab should be representative of the field that the farmer wants tested.

O Obtain information from the testing laboratories and share the information with students.

OBJECTIVE 8

Collect a soil sample. (Job Sheet)

R See the general instructions for all Job Sheets.

O Contact your local County Extension Agent for assistance and information about collecting and submitting soil samples.

OBJECTIVE 9

Complete a soil analysis form. (Assignment Sheet)

R See the general instructions for all Assignment Sheets.

O Obtain the Redco Science Kit "What's in a Soil?" and have students analyze the soil using the kit.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.
- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.
- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.
- Describe the rating scale used on the skills test.
- Reteach and retest as necessary.
- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.
- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.
- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.
- Complete the appropriate sections of the Competency Profiles.
- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- Johnson, Gordon V. *Causes and Effects of Soil Acidity*. OSU Extension Facts, No. 2239. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1992.

OPTIONAL RESOURCES

Publications

- Allen, Earl and Gordon Johnson. *Soil pH and Buffer Index*. OSU Extension Facts No. 2229. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- Allen, Earl and Gordon Johnson. *OSU Soil Test Interpretations*. OSU Extension Facts No. 2225. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

- Donahue, Roy L., et. al. *Our Soils and Their Management*, 6th edition. Danville, IL: Interstate Publishers, Inc., 1990.
- Foth, Henry D. *Fundamentals of Soil Science*, 8th edition. New York: John Wiley & Sons, 1990.
- Johnson, Gordon. *How to Get a Good Soil Sample*. OSU Extension Facts No. 2207. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach*. Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.
- Miller, Raymond W. and Roy L. Donahue. *Soils: An Introduction to Soils and Plant Growth*, 6th edition. Englewood Cliffs, NJ: Prentice Hall, 1990.
- Plaster, Edward J. *Soil Science & Management*, 2nd edition. Albany, NY: Delmar Publishers, 1992.

Other Media

- Redco Science Kit "What's in a Soil?" Available through CIMC, Oklahoma Department of Vocational and Technical Education. For ordering information call 800-522-5810.

UNIT REFERENCES

Publications

- Allen, Earl and Gordon Johnson. *Soil pH and Buffer Index*. OSU Extension Facts No. 2229. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- Allen, Earl and Gordon Johnson. *OSU Soil Test Interpretations*. OSU Extension Facts No. 2229. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- Boone, Lester V. *Producing Farm Crops*, 4th edition. Danville, IL: Interstate Publishers, Inc., 1991.
- Davies, D.B. *Soil Management*. Ipswich, United Kingdom: Farming Press, 1993.
- Donahue, Roy L., et. al. *Our Soils and Their Management*, 6th edition. Danville, IL: Interstate Publishers, Inc., 1990.

- Foth, Henry D. *Fundamentals of Soil Science*, 8th edition. New York: John Wiley & Sons, 1990.
- Johnson, Gordon. *How to Get a Good Soil Sample*. OSU Extension Facts No. 2207. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- Miller, Raymond W. and Roy L. Donahue. *Soils: An Introduction to Soils and Plant Growth*, 6th edition. Englewood Cliffs, NJ: Prentice Hall, 1990.
- Plaster, Edward J. *Soil Science & Management*, 2nd edition. Albany, NY: Delmar Publishers, 1992.
- Tisdale, Samuel L., et. al. *Soil Fertility and Fertilizers*, 5th edition. New York: MacMillian Publishing Company, 1993.

ASSIGNMENT SHEETS

OBJECTIVE 9

Assignment Sheet 1

Students answers will vary according to the area sampled.

WRITTEN TEST

OBJECTIVE 1

Answer should include the following in any order:

- Recommend fertilizer amounts to allow for optimum plant growth.
- Determine possible reasons for unsatisfactory plant growth.
- Help farmers maximize their profits.

OBJECTIVE 2

Answer should include the following in any order:

- Nitrogen
- Phosphorus
- Potassium
- Soil acidity
- Soluble salts
- Calcium
- Magnesium
- Sulfur
- Micronutrients

OBJECTIVE 3

1. Lowest pH reading for mineral soils
2. Strongly acidic
3. Moderately acidic
4. Slightly acidic
5. Neutral
6. Slightly alkaline
7. Moderately alkaline
8. Strongly alkaline
9. Highest pH reading for mineral soils

OBJECTIVE 4

2, 3, 5, 7, 8, 9, 11, 12, 13, 15

OBJECTIVE 5

1. Soil auger
2. Spade
3. Soil tube

OBJECTIVE 6

1. Determine the area (field) to be sampled.

2. Gather samples from random spots in the field, avoiding areas with unusual conditions.

3. Mix the subsamples thoroughly.

4. Place the sample in the container to be sent to the testing laboratory. Include any information required by the testing center.

OBJECTIVE 7

Answer should include the following in any order:

- Oklahoma State University Soil, Water, & Forage Analytical Laboratory – Stillwater, Oklahoma

- Noble Foundation – Ardmore, Oklahoma

- Private labs

OBJECTIVE 8

Evaluated on the Job Sheet.

OBJECTIVE 9

Evaluated on the Assignment Sheet.

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE – **B-2 Soil Sampling**

TOTAL NUMBER OF TEST QUESTIONS **46**

TOTAL NUMBER OF BASIC SKILL QUESTIONS **9**

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	**1-3**	**X**
2	**1-9**	**X**
3	**1-9**	**S**
4	**1-15**	**X**
5	**1-3**	**X**
6	**1-4**	**X**
7	**1-3**	**X**
8	**Evaluated on JS**	
9	**Evaluated on AS**	

INSTRUCTOR'S GUIDE

FERTILIZERS AND IRRIGATION

B-3

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read *Knowing When to Fertilize*, OSU Extension Facts No. 2236.

Writing

R Have students write a short essay (one paragraph to one page) describing the importance of knowing when to fertilize.

GENERAL INSTRUCTIONS

Assignment Sheets

- R Review the directions and any specific guidelines.
- R Make certain that any needed materials from the Instructor's Resource Package are available.
- R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.
- R Complete each student's Competency Profile.
- O Have the students volunteer to read aloud the directions and any special guidelines.
- O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

- R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.
- R Review and explain all general guidelines, safety cautions, and warnings.
- R Make sure that all tools, equipment, and supplies are available.
- R Demonstrate each of the procedures outlined in the Job Sheet.
- R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.
- R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.
- R Complete each student's Competency Profile.
- R Return the completed Job Sheets to the students so that they may use them for later reference if needed.
- O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1 **List factors that influence the use of fertilizers.**

O Discuss factors that influence the use of fertilizers. Ask students why they think fertilizers are an important factor in modern agriculture.

OBJECTIVE 2 **Describe categories of fertilizers.**

O Bring examples of the three categories of fertilizers for students to observe.

O Have students write a short research paper on the advantages and disadvantages of the different types of fertilizers.

O Have students research the use of sludge in your state or region and share their findings with the class.

OBJECTIVE 3 **Describe the forms in which fertilizers are provided.**

O Discuss the advantages and disadvantages of the forms of fertilizer.

O Bring examples of the different forms for students to observe.

OBJECTIVE 4 **Define green manures.**

O Discuss the use of green manures.

OBJECTIVE 5 **Match methods of applying fertilizers to their descriptions.**

- Invite your local county extension agent, a local crop producer, or chemical sales representative to discuss the different fertilization methods.

OBJECTIVE 6 **Name factors to consider in caring for fertilizer equipment.**

- Show students examples of fertilizer equipment and discuss why it is important to properly care for all equipment.

OBJECTIVE 7 **Match the primary plant nutrients to their characteristics.**

- Discuss the primary plant nutrients. Review the chemical abbreviations for the nutrients: nitrogen (N), phosphorus (P_2O_5), and potassium (K_2O). Discuss that phosphorus may be referred to as phosphoric acid and that potassium may be referred to as potash.
- Discuss that plants obtain 95% of their needs from carbon, oxygen, and hydrogen. These elements are obtained from air and water. The rest of the mineral nutrients are obtained from the soil.

OBJECTIVE 8 **Match the secondary plant nutrients to their characteristics.**

OBJECTIVE 9 **Name the micronutrients essential to plant growth.**

- Discuss secondary plant nutrients and micronutrients essential to plant growth. Emphasize that secondary and micronutrients are essential for plant growth.

OBJECTIVE 10 **Match nutrients to their deficiency symptoms.**

- Obtain *Sulfur Requirements of Oklahoma Crops*, OSU Extension Facts F-2237 and *Use of Fertilizer on Cotton*, OSU Extension Facts F-2210 and make them available for students to read.
- Bring examples of plants that have nutrient deficiencies to class and have students examine the plants and determine possible causes of deficiencies.

OBJECTIVE 11

Explain the Haber process of manufacturing nitrogen fertilizers.

- Obtain *Anhydrous Ammonia Safety*, OSU Extension Facts F-1723 and make it available for students to read. Discuss safety precautions that must be taken when using anhydrous ammonia.

OBJECTIVE 12

Select from a list information that must appear on fertilizer bags according to state law.

- Obtain *The Oklahoma Fertilizer Law*, OSU Extension Facts No. 2233 and make it available for students to read.
- Bring in sample labels from fertilizer bags and have students find the required information.

OBJECTIVE 13

Define fertilizer ratio.

- Give students examples of different fertilizers and have them calculate the fertilizer ratios.

OBJECTIVE 14

Discuss the percent nutrient value of specified fertilizers.

- Bring examples of fertilizer labels and have students find the grade and then determine the percentages of nitrogen, phosphate, and potash in the fertilizers.

OBJECTIVE 15

Complete a chart on the most desirable pH scale range for crops.

- Determine the soil pH of a plant that can be easily grown indoors. Grow two of the plants, one with an appropriate pH level and the other with low pH levels. Have students observe the difference between the two plants.
- Discuss management methods which farmers use to obtain proper pH such as liming or soil acidification.

OBJECTIVE 16

Select from a list the benefits of a liming program.

- Discuss the benefits of a liming program. Emphasize that liming is an important factor in soil improvement and that some farmers may not apply lime because the benefits are not readily seen. Show students some examples of liming materials.

O Obtain *Managing Acid Soils for Wheat Production*, OSU Extension Facts F-2240 and make it available for students to read.

O Discuss that soils with a high pH may be unfavorable for optimum plant growth. Soil acidification can be used to reduce the pH level. Several acidic or acid-forming materials may be used. Plants such as potatoes, blueberries, cranberries, azaleas, rhododendrons, and conifer seedlings may need soil acidification.

OBJECTIVE 17 **Collect plants with fertilizer deficiencies. (Assignment Sheet 1)**

R See the general instructions for all Assignment Sheets.

OBJECTIVE 18 **Calculate least-cost fertilizer material. (Assignment Sheet 2)**

R See the general instructions for all Assignment Sheets.

OBJECTIVE 19 **Calculate number of pounds of NPK available from different fertilizer analyses. (Assignment Sheet 3)**

R See the general instructions for all Assignment Sheets.

OBJECTIVE 20 **Calculate the cost per pound of nitrogen for different fertilizer analyses. (Assignment Sheet 4)**

R See the general instructions for all Assignment Sheets.

OBJECTIVE 21 **Determine fertilizer application rates, yield, and estimated return. (Assignment Sheet 5)**

R See the general instructions for all Assignment Sheets.

R Read the instruction book, load the software program onto a computer, and inform students on how to operate the program. Refer to the instruction book for soil and crop information needed to complete this Assignment Sheet. Supply this information to students.

O Have students select Option C: Find Best Fertilizer Application Rates Among Fields for Limited Fertilizer Investment. Supply students with the necessary information.

OBJECTIVE 22

Make a fertilizing schedule. (Assignment Sheet 6)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 23

Compare organic and inorganic fertilizing methods and costs. (Assignment Sheet 7)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 24

Determine application rate. (Assignment Sheet 8)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 25

Apply fertilizer. (Job Sheet 1)

R See the general instructions for all Job Sheets.

OBJECTIVE 26

List factors which determine whether or not irrigation is feasible.

OBJECTIVE 27

Match types of irrigation systems to their descriptions.

O Obtain *Classification of Irrigation Water Quality*, OSU Extension Facts No. 2401 and *Irrigation Water Qualities*, OSU Extension Facts No. 2404 and make them available for students to read.

O Discuss irrigation in areas where water conservation is very important, such as in some parts of California. Ask students what they think are some of the pros and cons of irrigating in areas where water is not as abundant.

O Have students observe some local irrigation systems, if possible.

O Show the video *Irrigation Techniques in Agriculture.*

OBJECTIVE 28

Explain the principles of fertigation.

O Discuss the principals of fertigation. Emphasize that not all fertilizers can be applied through fertigation.

OBJECTIVE 29

Calculate water needs. (Assignment Sheet 9)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 30

Determine when to irrigate. (Assignment Sheet 10)

R See the general instructions for all Assignment Sheets.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.
- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.
- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.
- Describe the rating scale used on the skills test.

- Reteach and retest as necessary.

- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.

- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.

- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.

- Complete the appropriate sections of the Competency Profiles.

- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Knowing When to Fertilize*, OSU Extension Facts No. 2236. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

- *OSU Soil Test Interpretations*, OSU Extension Facts No. 2225. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

Software

- *NPK$PLUS software program and instruction book.** Stillwater, OK: Oklahoma State University Cooperative Extension Service.

OPTIONAL RESOURCES

Publications

- Donahue, Roy L. et. al. *Our Soils and Their Management.* Danville, IL: Interstate Publishers, Inc. 1990.
- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.
- Miller, Raymond W. and Roy L. Donahue. *Soils: An Introduction to Soils and Plant Growth.* Englewood Cliffs, NJ: Prentice Hall, 1990.
- Plaster, Edward J. *Soil Science & Management,* 2nd ed. New York: Delmar Publishers, 1992.
- Tisdale, Samuel L. et. al. *Soil Fertility and Fertilizers,* 5th ed. New York: Macmillan Publishing Company, 1993.
- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.
- The following Oklahoma State University Extension Fact Sheets. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
  - ☐ F-1723 *Anhydrous Ammonia Safety*
  - ☐ F-2210 *Use of Fertilizer on Cotton*
  - ☐ F-2233 *The Oklahoma Fertilizer Law*
  - ☐ F-2237 *Sulfur Requirement of Oklahoma Crops*
  - ☐ F-2240 *Managing Acid Soils for Wheat Production*
  - ☐ F-2401 *Classification of Irrigation Water Quality*
  - ☐ F-2404 *Irrigation Water Qualities*

☑ **NOTE:** For information on obtaining the above fact sheets contact your local county extension office.

Videos

- *Irrigation Techniques in Agriculture.* Lubbock, TX: Creative Education Video.

☑ **NOTE:** For ordering information contact Oklahoma Department of Vocational and Technical Education 800-522-5810.

UNIT REFERENCES

Publications

- Donahue, Roy L. et. al. *Our Soils and Their Management.* Danville, IL: Interstate Publishers, Inc. 1990.
- Foth, Henry D. *Fundamentals of Soil Science.* New York: John Wiley & Sons, 1990.
- Miller, Raymond W. and Roy L. Donahue. *Soils: An Introduction to Soils and Plant Growth.* Englewood Cliffs, NJ: Prentice Hall, 1990.
- *OSU Soil Test Interpretations*, OSU Extension Facts No. 2225. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1993.
- Plaster, Edward J. *Soil Science & Management*, 2nd ed. New York: Delmar Publishers, 1992.
- Tisdale, Samuel L. et. al. *Soil Fertility and Fertilizers*, 5th ed. New York: Macmillan Publishing Company, 1993.

ASSIGNMENT SHEETS

OBJECTIVE 17

Assignment Sheet 1

Student answers will vary. Students should collect at least five plants with symptoms of nutrient deficiencies.

OBJECTIVE 18

Assignment Sheet 2

Student answers will vary with the fertilizers used.

OBJECTIVE 19

Assignment Sheet 3

1. N = 10 pounds, P = 5 pounds, K = 5 pounds
2. N = 100 pounds, P = 300 pounds, K = 600 pounds
3. N = 20 pounds, P = 10 pounds, K = 5 pounds
4. N = 82 pounds, P = 0, K = 0
5. N = 9 pounds, P = 23 pounds, K = 0

OBJECTIVE 20

Assignment Sheet 4

Student answers will vary with the local price per ton of nitrogen.

OBJECTIVE 21

Assignment Sheet 5

Student answers will vary.

OBJECTIVE 22

Assignment Sheet 6

Student answers will vary. Reports should indicate the best times to fertilize the chosen crop.

OBJECTIVE 23

Assignment Sheet 7

Student answers will vary with the types of fertilizers chosen.

OBJECTIVE 24

Assignment Sheet 8

1. 500 lbs
2. 67 lbs
3. 122 lbs

OBJECTIVE 29

Assignment Sheet 9

1. 1.95
2. 3.6
3. 1.7

OBJECTIVE 30

Assignment Sheet 10

Student answers will vary depending on the soil samples used.

WRITTEN TEST

OBJECTIVE 1

Answer should include the following:

- Chemical condition of the soil
- Crops
- Physical condition of the soil
- Insects and diseases
- Climatic conditions
- Time

OBJECTIVE 2

Answer should include the following:

- **Mineral fertilizers** – ground rocks which contain nutrients; the majority of minerals dissolve slowly limiting their usefulness as fertilizers

- **Organic fertilizers** – organic materials that contain nutrients; the benefits of many organic fertilizers are obtained slowly as the organic matter decays

- **Inorganic fertilizers (chemical fertilizers)** – fertilizers made by industry; some may be mined but many are entirely manufactured; generally have a higher proportion of usable nutrients than mineral or organic fertilizers

OBJECTIVE 3

Answer should include the following:

- **Pressurized liquids** – liquid is applied by injecting it into the soil from tanks; pressure in the tanks forces the liquid through chisels that are pulled underground; when the liquid reaches the soil, it evaporates

- **Fluid fertilizers** – liquids that are not under pressure; solutions are the most common fluid fertilizers; suspensions can also be used; fluid fertilizers can be applied in various ways such as by spraying on a field, injecting into the soil, or mixing with irrigation water

- **Dry fertilizers** – fertilizers that are applied to soil and dissolve quickly in soil water to release nutrients; available in three forms: pulverized fertilizers which are powders made from crushing fertilizers; granules, which are large, evenly sized grains; and prills which are smooth, round, and dust-free

- **Slow-release fertilizers** – dry fertilizers which contain nutrients that dissolve into the soil solution slowly; time period generally ranges from several weeks to a few months; most commonly used in horticulture

OBJECTIVE 4

Green manures are crops that are grown for the purpose of being turned under while green or immediately after maturity for soil improvement.

OBJECTIVE 5

1. D
2. F
3. H
4. B
5. A
6. I
7. L
8. K

OBJECTIVE 6

Answer should include the following:

- Remove all fertilizer from the hopper after use.
- Clean the hopper thoroughly with water.
- Allow the hopper to dry.
- Clean out the auger.
- Apply a mixture of 50% kerosene and oil to the hopper.

OBJECTIVE 7

1. N, P
2. P
3. P
4. N
5. K
6. K
7. P
8. N
9. K
10. P
11. N
12. N
13. K
14. P
15. K

OBJECTIVE 8

1. C
2. C
3. S
4. S
5. M
6. M
7. M
8. C
9. M
10. C
11. S
12. M
13. M
14. S
15. C
16. C

OBJECTIVE 9

Answer should include the following:

- Boron
- Iron
- Manganese
- Zinc
- Copper
- Chlorine
- Molybdenum

OBJECTIVE 10

1. A
2. C, F
3. A
4. D
5. C
6. E
7. H
8. E

OBJECTIVE 11

Answer should include key points from the following:

- The *Haber process* is the process by which fertilizer companies manufacturer most nitrogen carriers.
- Nitrogen from the air is used in the Haber process. The hydrogen source, natural gas, is combined with gaseous nitrogen.
- Ammonia is produced from this reaction, with the presence of heat, pressure, and an iron catalyst.
  - $3H_2 + N_2 \text{ ----> } 2NH_3$
- Ammonia can then be used as a fertilizer or changed to other forms.
  - Anhydrous ammonia results directly from the Haber process. It is 82% nitrogen.
  - Anhydrous ammonia is relatively inexpensive compared to other forms of nitrogen fertilizer and is the strongest form of nitrogen.

OBJECTIVE 12

1, 3, 5, 6

OBJECTIVE 13

Fertilizer ratio is the relative amounts of nitrogen (N), phosphorous (P_2O_5), and potassium (K_2O) in fertilizers. The ratios NPK are always given in that order in a fertilizer.

OBJECTIVE 14

1. The fertilizer grade indicates the primary nutrient content of the fertilizer. The grade lists the percentage of nitrogen (N), phosphate (P_2O_5), and potash (K_2O).
2. The grade is stated as "N-P-K," which refers to nitrogen, phosphorus, and potassium. The nutrients are always listed in that order.
3. A fertilizer with a grade of 20-10-10 is 20% nitrogen, 10% phosphoric acid, and 10% potash.
4. The remaining percentage of the fertilizer is mainly the weight of the other elements that are part of the carrier, such as hydrogen and oxygen. Fillers and conditioners make up a small percentage of the fertilizer.

OBJECTIVE 15 Chart should be completed as shown below.

Crop	pH Range
Crimson clover, vetch	1. 5.5-7.0
Peanuts, soybeans	2. 5.8-7.0
Alsike, red, and white clovers	3. 6.0-7.0
Alfalfa, sweet clover	4. 6.2-7.5
Bluestem, fescue, native hay, weeping lovegrass	5. 4.5-7.0
Corn, oats, orchardgrass, ryegrass, sorghum, wheat	6. 5.5-7.0
Bermudagrass	7. 5.7-7.0
Barley	8. 6.5-7.0
Cotton	9. 5.7-7.0

OBJECTIVE 16 1, 3, 5, 6, 8

OBJECTIVE 17 **Evaluated on Assignment Sheet 1.**

OBJECTIVE 18 **Evaluated on Assignment Sheet 2.**

OBJECTIVE 19 **Evaluated on Assignment Sheet 3.**

OBJECTIVE 20 **Evaluated on Assignment Sheet 4.**

OBJECTIVE 21 **Evaluated on Assignment Sheet 5.**

OBJECTIVE 22 **Evaluated on Assignment Sheet 6.**

OBJECTIVE 23 **Evaluated on Assignment Sheet 7.**

OBJECTIVE 24 **Evaluated on Assignment Sheet 8.**

OBJECTIVE 25

Evaluated on Job Sheet 1.

OBJECTIVE 26

Answer should include any six of the following:

- Availability of an adequate water source
- Plant use of water (consumptive use)
- Topography
- Labor available
- Crops to be grown
- Soil characteristics
- Capital and maintenance costs
- Energy requirements
- Cost of land preparation
- Economical benefit from the irrigation (crop yields and price)

OBJECTIVE 27

1. F
2. J
3. D
4. H
5. A
6. E
7. B

OBJECTIVE 28

1. Fertigation is the application of fertilizers through irrigation systems. Fertigation is most efficient when used in sprinkler or trickle irrigation, but can be used with surface irrigation systems. Fertigation will only be as efficient and uniform as the irrigation system.
2. The principle nutrients supplied by fertigation are nitrogen and sulphur.

3. Advantages of fertigation include:

   - ☐ application of nutrients close to the time the plants have the greatest need for them
   - ☐ elimination of one or more field operations

OBJECTIVE 29 **Evaluated on Assignment Sheet 9.**

OBJECTIVE 30 **Evaluated on Assignment Sheet 10.**

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE – B-3 Fertilizers and Irrigation

TOTAL NUMBER OF TEST QUESTIONS 118

TOTAL NUMBER OF BASIC SKILL QUESTIONS 15

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-6	X
2	1-3	W
3	1-4	W
4	1	X
5	1-8	X
6	1-5	X
7	1-15	X
8	1-16	X
9	1-7	X
10	1-8	X
11	1	W,S
12	1-6	X
13	1	X
14	1-4	W,S
15	1-9	X
16	1-8	X
17	Evaluated on AS 1	
18	Evaluated on AS 2	

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
19	**Evaluated on AS 3**	
20	**Evaluated on AS 4**	
21	**Evaluated on AS 5**	
22	**Evaluated on AS 6**	
23	**Evaluated on AS 7**	
24	**Evaluated on AS 8**	
25	**Evaluated on JS 1**	
26	1-6	X
27	1-7	X
28	1-3	W
29	**Evaluated on AS 9**	
30	**Evaluated on AS 10**	

INSTRUCTOR'S GUIDE

SOIL CONSERVATION PRACTICES B-4

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read *Wetlands Determinations, Definitions, and Management Options*, OSU CR-876.

Writing

R Have students write a short essay on wetlands. Have students include a discussion of their opinion on why it is important to properly manage wetland areas.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1 **Describe the effects of wind and water erosion.**

O Discuss the effects of wind and water erosion. Ask students for examples of erosion in your area.

O Visit your local conservation district office and obtain information and publications on erosion. Find out information about guest speakers. Make arrangements for a guest speaker to come to class and speak on erosion. Publications available include: *Soil Erosion By Wind*, *Soil Erosion By Water*, *Assistance Available from the Soil Conservation Service*, and *Going Wild With Soil and Water Conservation*.

OBJECTIVE 2 **Match degrees of erosion to their correct definitions.**

O Discuss degrees of erosion. Bring photos of different degrees of erosion and ask students to determine the degree of erosion or give students specific sites in your area and have them determine the degree of erosion.

OBJECTIVE 3 **Match categories of water erosion to their correct definitions.**

O Discuss categories of water erosion. Bring photos of different water erosion and ask students to determine the types of erosion or give students specific sites in your area and have them determine the types of erosion.

OBJECTIVE 4 **List management practices that aid in water erosion control.**

OBJECTIVE 5 **Select from a list management practices that control wind erosion.**

- O Invite a soil conservation specialist to speak to the class about management practices that help control wind and water erosion.

- O Contact the Conservation Technology Information Center for information on watershed management: Know Your Watershed, CTIC, 1220 Potter Drive, Room 170, West Lafeyette, IN 47906, phone (317) 494-9555. Show the video *Partnerships For Watersheds* available from the Conservation Technology Information Center.

- O Contact local government agencies such as the USDA's Natural Resources Conservation Service (NRCS), your local conservation district office, or the local Extension Service for information and publications on soil conservation programs. Publications available from the NRCS include *Save Soil Systematically* and *Farming and Maintaining Terraces.*

- O Have students write a short paper on the importance of soil conservation. Have student give a brief (5 minutes or less) oral report on their findings.

OBJECTIVE 6 **Describe benefits of artificial drainage.**

- O Discuss the benefits of artificial drainage. Have students examine fields which have artificial drainage.

OBJECTIVE 7 **Define conservation tillage.**

OBJECTIVE 8 **Explain the principles of conservation tillage.**

- O Contact local government agencies such as the USDA's Natural Resources Conservation Service (NRCS), your local conservation district office, or the local Extension Service for information and publications on conservation tillage.

- O Obtain the following OSU publications and make them available for students to read: CR-1213, *Understanding "Lo-Till" Planters*; F-1221, *Planting and Conservation Tillage*; and CR-2900, *Evaluation of Lo-Till Demonstrations.* Also obtain NRCS publication, *Tillage Options for Conservation Farmers* and make it available for students to read.

O Have students examine fields which have been farmed under various tillage methods. Ask students what differences they notice in the fields.

O Have students write a report comparing conventional tillage and conservation tillage. Have students include the advantages and disadvantages of each method.

OBJECTIVE 9

Determine degrees of erosion. (Assignment Sheet 1)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 10

Determine ways to stop soil erosion. (Assignment Sheet 2)

R See the general instructions for all Assignment Sheets.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.
- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.
- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.
- Describe the rating scale used on the skills test.
- Reteach and retest as necessary.
- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.
- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.
- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.
- Complete the appropriate sections of the Competency Profiles.
- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Wetlands Determinations, Definitions, and Management Options*, OSU CR-876. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

OPTIONAL RESOURCES

Publications

- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.
- Miller, Raymond W. and Roy L. Donahue. *Soils: An Introduction to Soils and Plant Growth*, 6th ed. Englewood Cliffs, NJ: Prentice Hall, 1990.
- Plaster, Edward J. *Soil Science & Management*, 2nd ed. Albany, NY: Delmar Publishers, 1992.
- The following Oklahoma State University publications. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
  - ☐ CR-1213 *Understanding "Lo-Till" Planters*
  - ☐ F-1221 *Planting and Conservation Tillage*
  - ☐ CR-2900 *Evaluation of Lo-Till Demonstrations*

  ☑ **NOTE:** To obtain Oklahoma State University Cooperative Extension Service publications contact your local county extension office.

- The following Natural Resources Conservation Service publications:
  - ☐ *Soil Erosion By Wind*
  - ☐ *Soil Erosion By Water*
  - ☐ *Assistance Available from the Soil Conservation Service*
  - ☐ *Going Wild With Soil and Water Conservation*
  - ☐ *Save Soil Systematically*
  - ☐ *Farming and Maintaining Terraces.*
  - ☐ *Tillage Options for Conservation Farmers* and

  ☑ **NOTE:** To obtain NRCS publications contact your local conservation district office.

UNIT REFERENCES

Videos

- *Partnerships For Watersheds.* Contact the Conservation Technology Information Center for information on watershed management: Know Your Watershed, CTIC, 1220 Potter Drive, Room 170, West Lafeyette, IN 47906, phone (317) 494-9555.

Publications

- Boone, Lester V. *Producing Farm Crops*, 4th ed. Danville, IL: Interstate Publishers, Inc., 1991.
- Davies, D.B. *Soil Management.* Ipswich, United Kingdom: Farming Press, 1993.
- Donahue, Roy L., et. al. *Our Soils and Their Management*, 6th edition. Danville, IL: Interstate Publishers, Inc., 1990.
- Foth, Henry D. *Fundamentals of Soil Science*, 8th ed. New York: John Wiley & Sons, 1990.
- Miller, Raymond W. and Roy L. Donahue. *Soils: An Introduction to Soils and Plant Growth*, 6th ed. Englewood Cliffs, NJ: Prentice Hall, 1990.
- Plaster, Edward J. *Soil Science & Management*, 2nd ed. Albany, NY: Delmar Publishers, 1992.
- Tisdale, Samuel L., et. al. *Soil Fertility and Fertilizers*, 5th ed. New York: MacMillian Publishing Company, 1993.

ASSIGNMENT SHEETS

OBJECTIVE 9

Assignment Sheet 1

1. Percent of erosion = 79%
   Degree of erosion = Severe

2. Percent of erosion = 67%
   Degree of erosion = Moderate

3. Percent of erosion = 80%
   Degree of erosion = Very severe

OBJECTIVE 10

Assignment Sheet 2

Student answers will vary according to the site selected.

WRITTEN TEST

OBJECTIVE 1

1. Eroded soil pollutes rivers, lakes, and streams with nutrients and pesticides which can adversely affect the biological activity in and around the water.

2. Soil sediment from erosion settles in streams, lakes, harbors, and reservoirs. This sediment causes problems such as creating the need for dredging to clear harbors and waterways, reducing the ability of streams to carry water which increases the likelihood of flooding, and causing reservoirs to hold less water because of the sediment buildup.

3. Severe erosion, such as gullies, removes a large amount of soil, and makes it difficult or impossible to operate farm equipment over the eroded areas.

4. Erosion causes the soil profile to become thinner and decreases the root zone. This also causes the soil to lose water-holding capacity.

5. When the topsoil is eroded, much of the soil's organic matter and plant nutrients such as nitrogen and phosphorus are lost.

6. Erosion removes topsoil which provides the best growing medium for plants.

OBJECTIVE 2

1. F
2. D
3. E
4. A

OBJECTIVE 3

1. D
2. G
3. A
4. F
5. C

OBJECTIVE 4

Answer should include the following:

- Conservation tillage
- Crop rotation
- Planting cover crops
- Providing waterways
- Contour farming
- Strip-cropping
- Terraces
- Improving organic matter
- Diversions

OBJECTIVE 5

1, 2, 4, 6

OBJECTIVE 6

1. Answer should include the following points:
    - Improves aeration
    - Increases earthworm activity which creates more holes in the soil which allows more oxygen for plant roots
    - Improves soil structure
2. By decreasing surface water runoff and the resulting soil erosion
3. Answer should include three of the following points:
    - Allows wet soils, which are generally the most fertile, to be used for productive purposes.
    - Increases crop yields
    - Land is adapted to a wider variety of crops.
    - Proper drainage makes the field more uniform in soil moisture allowing for better planning and management of tillage, planting, and harvesting operations.
4. It allows for deeper penetration of plant roots, which increases the amounts of nutrients available to plants
5. Answer should include three of the following points;
    - Decreases damage to plant roots and plants from frost heaving and drought
    - Reduces mosquito and fly populations
    - Decreases weed infestation
    - Decreases incidence of crop diseases such as root rots
    - Reduces the accumulation of toxic substances in the soil

OBJECTIVE 7

Conservation tillage refers to tillage practices that provide for control of wind and water erosion partially by managing crop residues. At least 30 percent of the soil surface is covered by plant residues to control water erosion.

OBJECTIVE 8

Answer should include the following points in any order:

- Conservation tillage reduces soil erosion.
- Instead of plowing under crop residues, some or even all of the crop residue is left on the soil surface. A field under conservation tillage has at least 30 percent of the soil surface covered by crop residues.
- The type of conservation tillage used for a particular field depends on factors such as crops grown, soil characteristics, and climate.

OBJECTIVE 9

Evaluated on Assignment Sheet 1.

OBJECTIVE 10

Evaluated on Assignment Sheet 2.

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE — B-4 Soil Conservation Practices

TOTAL NUMBER OF TEST QUESTIONS 39

TOTAL NUMBER OF BASIC SKILL QUESTIONS 15

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	**1-6**	**W, S**
2	**1-4**	**X**
3	**1-5**	**X**
4	**1-9**	**X**
5	**1-6**	**X**
6	**1-5**	**W, S**
7	**1**	**W, S**
8	**1-3**	**W, S**
9	**Evaluated on AS 1**	
10	**Evaluated on AS 2**	

INSTRUCTOR'S GUIDE

LAND USES AND CLASSIFICATION

C-1

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read OSU Fact Sheet No. F-808, *Environmental Regulations Affecting Land Use.*

Writing

R Have students write a short essay on environmental regulations affecting land use. Have students include a discussion of their opinion on environmental regulations.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

Name reasons for judging land.

O Discuss reasons for judging land. Ask students why they think it is important to be able to judge land. Invite a county extension specialist or other knowledgeable person to speak to the class about judging land.

O Obtain publications such as *Land Judging in Oklahoma* or the vocational agricultural education land judging guidelines and make them available for students to read.

OBJECTIVE 2

List factors that determine land capability class.

O Have students write a short paragraph discussing each of the factors.

OBJECTIVE 3

Match degrees of permeability to their correct soil characteristics.

O Bring samples of soils that have different degrees of permeability. Let students examine the soils.

O Have students refer to textbooks on land uses and classifications for further information.

OBJECTIVE 4

Match rates of surface runoff to their correct definitions.

O Have students refer to textbooks on land uses and classifications for further information.

OBJECTIVE 5 **Match land capability classes to their correct definitions.**

O Have students refer to textbooks on land uses and classifications or land judging guidelines for further information.

OBJECTIVE 6 **Complete a chart on correct suitable uses of land capability classes.**

O Have students think about areas of land they are familiar with and ask them what land capability class they think that site would be in. For example, a wooded area near a lake used for recreation.

OBJECTIVE 7 **Complete a chart on the best land capability class possible for certain soil factors.**

O Have students refer to textbooks on land uses and classifications or land judging guidelines for further information.

OBJECTIVE 8 **List recommended land treatments applied to land capability classes.**

OBJECTIVE 9 **Match types of vegetative practices to the correct land capability classes each is applied to.**

OBJECTIVE 10 **Match types of mechanical treatments to their correct uses.**

O Discuss land treatments applied to land capability classes. Emphasize that each treatment is not appropriate for all land. Ask students why management abilities such as evaluating, planning, organizing, and taking action are important when dealing with land treatments.

O Have students refer to textbooks on land uses and classifications or land judging guidelines for further information.

OBJECTIVE 11

Match factors that affect land capability class to the correct land treatments applied to each.

O Have students refer to textbooks on land uses and classifications or land judging guidelines for further information.

OBJECTIVE 12

Complete a land judging score card when given the characteristics of a field. (Assignment Sheet 1)

R See the general instructions for all Assignment Sheets.

R Show the video *Land Judging.*

O Show the video *Practice Land Judging.*

OBJECTIVE 13

Judge a field and complete the score card. (Assignment Sheet 2)

R See the general instructions for all Assignment Sheets.

R Review the video *Land Judging.*

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.

- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.
- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.
- Describe the rating scale used on the skills test.
- Reteach and retest as necessary.
- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.
- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.
- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.
- Complete the appropriate sections of the Competency Profiles.
- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Environmental Regulations Affecting Land Use.* OSU Fact Sheet No. F-808. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

Videos

- *Introduction to Land Judging.* Lubbock, TX: Creative Educational Video.

  ☑ **NOTE:** This video is available through CIMC, Oklahoma Department of Vocational and Technical Education. For ordering information call 800-522-5810.

OPTIONAL RESOURCES

Publications

- *Land Judging in Oklahoma.* Stillwater, OK: Oklahoma Cooperative Extension Service.
- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.
- Miller, Raymond W. and Roy L. Donahue. *Soils: An Introduction to Soils and Plant Growth*, 6th ed. Englewood Cliffs, NJ: Prentice Hall, 1990.
- Plaster, Edward J. *Soil Science & Management*, 2nd ed. Albany, NY: Delmar Publishers, 1992.

Videos

- *Practice Land Judging.* Lubbock, TX: Creative Educational Video.

  ☑ **NOTE:** This video is available through CIMC, Oklahoma Department of Vocational and Technical Education. For ordering information call 800-522-5810.

UNIT REFERENCES

Publications

- Boone, Lester V. *Producing Farm Crops*, 4th ed. Danville, IL: Interstate Publishers, Inc., 1991.
- Davies, D.B. *Soil Management*. Ipswich, United Kingdom: Farming Press, 1993.
- Donahue, Roy L., et. al. *Our Soils and Their Management*, 6th ed. Danville, IL: Interstate Publishers, Inc., 1990.
- Foth, Henry D. *Fundamentals of Soil Science*, 8th ed. New York: John Wiley & Sons, 1990.
- *Land Judging in Oklahoma*. Stillwater, OK: Oklahoma Cooperative Extension Service.
- Miller, Raymond W. and Roy L. Donahue. *Soils: An Introduction to Soils and Plant Growth*, 6th ed. Englewood Cliffs, NJ: Prentice Hall, 1990.
- Plaster, Edward J. *Soil Science & Management*, 2nd ed. Albany, NY: Delmar Publishers, 1992.
- Tisdale, Samuel L., et. al. *Soil Fertility and Fertilizers*, 5th ed. New York: MacMillian Publishing Company, 1993.

ASSIGNMENT SHEETS

OBJECTIVE 12

Assignment Sheet 1

Students should fill out a Land Judging Score Card for each case study.

OBJECTIVE 13

Assignment Sheet 2

Student answers will vary. Forms should be completely filled out.

WRITTEN TEST

OBJECTIVE 1

Answers should include the following in any order:

- To understand basic soil differences and how they affect crop production.
- To understand different soil and water conservation practices.
- To understand the influence of land features on production and land protection.
- To determine management practices important to proper use of soil and water.
- To determine land capability classes.

OBJECTIVE 2

Answers should include the following in any order:

- Soil texture
- Depth of soil
- Slope
- Erosion
- Soil permeability
- Surface runoff

OBJECTIVE 3

1. E
2. C
3. A
4. F

OBJECTIVE 4

1. A
2. B
3. C
4. F

OBJECTIVE 5

1. B
2. A
3. H
4. C
5. D
6. F
7. E
8. G

OBJECTIVE 6

Chart should be completed as shown below.

	Class							
	I	II	III	IV	V	VI	VII	VIII
Crop production	X	X	X					
Hay	X	X	X	X				
Pasture	X	X	X	X	X	X	X	
Range	X	X	X	X	X	X	X	
Woodland	X	X	X	X	X	X	X	
Wildlife	X	X	X	X	X	X	X	X
Watershed	X	X	X	X	X	X	X	X
Recreation	X	X	X	X	X	X	X	X

OBJECTIVE 7

Chart should be completed as shown below.

Land Capability Factor	Soil Factor	Best Land Class
Texture	Coarse	III
	Moderately coarse, medium, moderately fine, fine	I
Depth	Deep, moderately deep	I
	Shallow	III
	Very Shallow	VII
Permeability	Rapid	III
	Moderate, slow	I
	Very slow	II
Slope	Nearly level (0% to 1%)	I
	Gently sloping (1% to 3%)	II
	Moderately sloping (3% to 5%)	III
	Strongly sloping (5% to 8%)	IV
	Steep (8% to 15%), very steep (15% and over)	VI
Erosion	None to slight	I
	Moderate	II
	Severe, very severe	VI
Surface runoff	Rapid	III
	Moderate, slow	I
	Very slow	II

OBJECTIVE 8

Answer should include the following in any order:

- Vegetative practices
- Mechanical practices
- Fertilizer and lime

OBJECTIVE 9

1. A
2. B
3. D
4. C
5. H
6. A, B, C, D
7. A, B, C, D
8. E, F, G, H
9. E, F, G, H
10. E, F, G, H
11. E, F, G, H
12. E, F, G
13. E, F, G

OBJECTIVE 10

1. D
2. C
3. G
4. A
5. F
6. E
7. H

OBJECTIVE 11

1. A, D
2. C
3. E
4. B
5. F

OBJECTIVE 12

Evaluated on Assignment Sheet 1.

OBJECTIVE 13

Evaluated on Assignment Sheet 2.

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE — C-1 Land Uses and Classification

TOTAL NUMBER OF TEST QUESTIONS 57

TOTAL NUMBER OF BASIC SKILL QUESTIONS 27

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-5	X
2	1-6	X
3	1-4	X
4	1-4	X
5	1-8	X
6	1	S
7	1	S
8	1-3	X
9	1-13	S
10	1-7	S
11	1-5	S
12	Evaluated on AS 1	
13	Evaluated on AS 2	

INSTRUCTOR'S GUIDE

LEGAL LAND DESCRIPTIONS

C-2

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read OSU Fact Sheet F-9407, *Legal Land Descriptions in Oklahoma.*

Writing

R Have students write a short (one paragraph) discussion on legal land descriptions in Oklahoma. Have students include why they believe understanding land descriptions is important.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

State reasons for using legal land descriptions.

O Discuss reasons for using legal land descriptions. Ask students what problems might occur if landowners are not clear about the boundaries of their land.

O Research or ask students to research the types of legal land descriptions used in your county. Obtain a copy of the legal land description of the school and share it with students.

O Arrange a field trip to the county courthouse to look up deeds and land descriptions.

O Discuss issues that coincide with legal land descriptions such as easements, covenants, and restrictions on land.

O Obtain OSU Fact Sheet AF-156, *Considerations in Negotiating Land Easements* and make it available for students to read.

O Invite a surveyor to speak to the class about land location and using legal land descriptions.

OBJECTIVE 2

Match line divisions used in the United States Public Land Survey (USPLS) to their descriptions.

OBJECTIVE 3

Choose the correct word or phrase to complete statements about subdivisions.

R Use Transparency Master 1 to illustrate rectangular system subdivisions.

O Have students locate their quadrangle, township, and range.

O Locate markers or monuments near the school for students to see.

OBJECTIVE 4

Choose the correct word or phrase about reading USPLS system subdivision sections.

O Give students examples of legal descriptions and have them read them.

OBJECTIVE 5

Identify principal meridians, base lines, and initial points.

R Use Transparency Master 2 to illustrate the principal meridians, base lines, and initial points.

O Have students identify the guide meridians and standard parallels nearest to your area.

OBJECTIVE 6

Identify subdivisions of the USPLS system. (Assignment Sheet 1)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 7

Interpret descriptions for the subdivision of a section. (Assignment Sheet 2)

R See the general instructions for all Assignment Sheets.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.
- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.

- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.

- Describe the rating scale used on the skills test.

- Reteach and retest as necessary.

- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.

- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.

- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.

- Complete the appropriate sections of the Competency Profiles.

- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Legal Land Descriptions in Oklahoma.* OSU Fact Sheet No. F-9407. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

OPTIONAL RESOURCES

Publications

- *Considerations in Negotiating Land Easements.* OSU Ag Facts AF-156. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.

Other Media

- Examples of legal land descriptions such as titles and deeds.

UNIT REFERENCES

Publications

- *Forestry.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1991.

- Miller, Raymond W. and Roy L. Donahue. *Soils: An Introduction to Soils and Plant Growth,* 6th ed. Englewood Cliffs, NJ: Prentice-Hall, 1990.

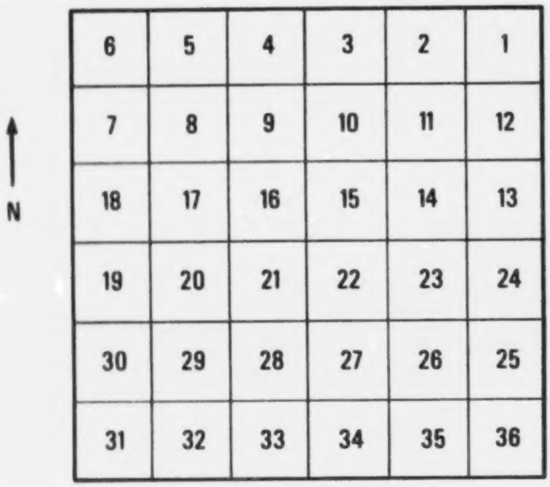
ASSIGNMENT SHEETS

OBJECTIVE 6

Assignment Sheet 1

1. a. (Example)
   b. T2N, R7E
   c. T3S, R3E
   d. T2S, R4W
   e. T1N, R7W

2.



6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

3. a. 3
   b. 8
   c. 30
   d. 31
   e. 36

OBJECTIVE 7

Assignment Sheet 2

PART 1

A. NW1/4 NW1/4, Section 10
ACRES: 40

B. S1/2 NE1/4, Section 36
ACRES: 80

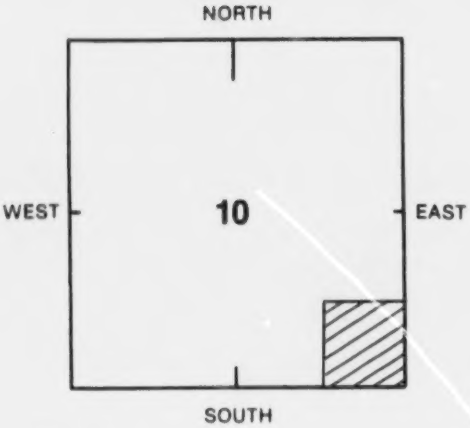
C. N1/2 SE1/4, Section 9
ACRES: 80

D. E1/2 NW1/4 NE1/4, Section 2
ACRES: 20

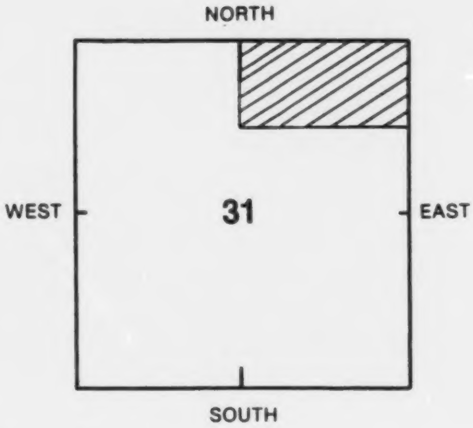
E. SW1/4 AND N1/2 SE1/4, Section 15
ACRES: 240

F. N1/2 NE1/4 NE1/4, Section 20
ACRES: 20

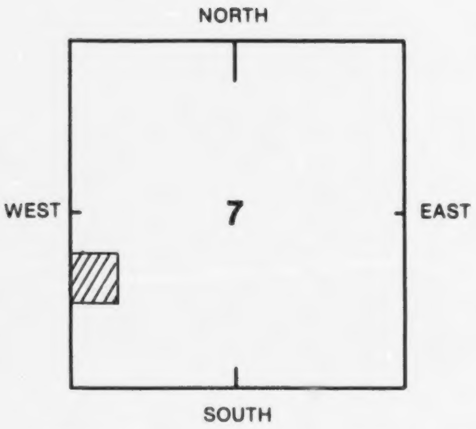
PART 2


NORTH
WEST
10
EAST
SOUTH

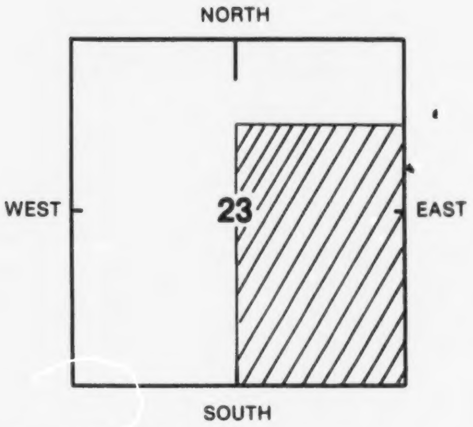
40 acres


NORTH
WEST
31
EAST
SOUTH

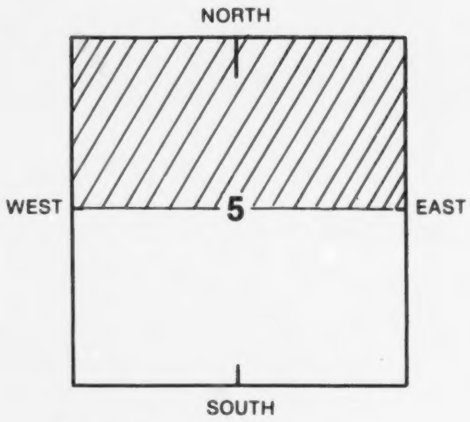
B. 80 acres


NORTH
WEST
7
EAST
SOUTH

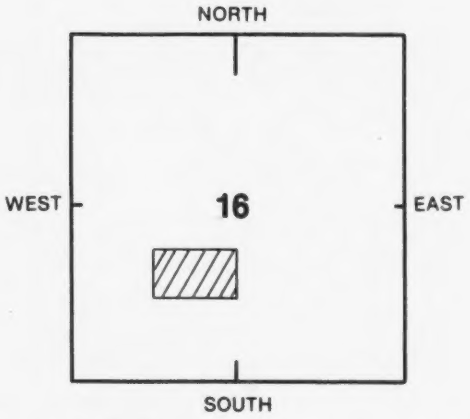
C. 10 acres


NORTH
WEST
23
EAST
SOUTH

D. 240 acres


NORTH
WEST
5
EAST
SOUTH

E. 320 acres


NORTH
WEST
16
EAST
SOUTH

F. 20 acres

WRITTEN TEST

OBJECTIVE 1

Answer should include the following in any order:

- Retrace old boundary lines
- Locate property boundaries
- Lay out boundaries for specific uses
- Custom application

OBJECTIVE 2

1. I
2. D
3. G
4. L
5. C
6. K
7. A

OBJECTIVE 3

1. C
2. B
3. A
4. D
5. B
6. A
7. B
8. B
9. A
10. C
11. D
12. B

OBJECTIVE 4

1. B
2. D
3. B
4. A
5. A
6. B

OBJECTIVE 5

1. Cimarron Meridian
2. Indian Meridian
3. Standard Parallel Lines
4. Base Lines
5. Starting Points
6. Guide Meridians

OBJECTIVE 6

Evaluated on Assignment Sheet 1.

OBJECTIVE 7

Evaluated on Assignment Sheet 2.

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) ***Soil, Plant, and Crop Science***

UNIT NUMBER AND TITLE – C-2 Legal Land Descriptions

TOTAL NUMBER OF TEST QUESTIONS 35

TOTAL NUMBER OF BASIC SKILL QUESTIONS 0

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	**1-4**	**X**
2	**1-7**	**X**
3	**1-12**	**X**
4	**1-6**	**X**
5	**1-6**	**X**
6	**Evaluated on AS 1**	
7	**Evaluated on AS 2**	

INSTRUCTOR'S GUIDE

GROWTH AND REPRODUCTION

D-1

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Read *Hybrid Sorghum Performance Trials in Oklahoma, 1990*, OSU Extension Circular No. 866.

Writing

R Have the students write a short essay (one paragraph to one page) on the results of one performance trial.

GENERAL INSTRUCTIONS

Assignment Sheets

- R Review the directions and any specific guidelines.
- R Make certain that any needed materials from the Instructor's Resource Package are available.
- R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.
- R Complete each student's Competency Profile.
- O Have the students volunteer to read aloud the directions and any special guidelines.
- O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

- R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.
- R Review and explain all general guidelines, safety cautions, and warnings.
- R Make sure that all tools, equipment, and supplies are available.
- R Demonstrate each of the procedures outlined in the Job Sheet.
- R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.
- R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.
- R Complete each student's Competency Profile.
- R Return the completed Job Sheets to the students so that they may use them for later reference if needed.
- O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

- R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.
- R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

Arrange in order the stages in the life cycle of plants.

- R Discuss transparency 1 showing the life cycles of plants.
- O Have students sprout several seeds in a clear glass jar full of water. They should check on and note the progress the seeds make from stage to stage. Students may pull out, mount, and label samples of each stage on a poster board or some other type of display.
- O Have students create a chart showing the different lengths of time various plants spend in each stage of their lives.

OBJECTIVE 2

Explain transpiration.

- O Have students listen to a weather report that covers a week-long forecast (the forecast should include information about the expected levels of humidity, wind activity, and temperature), then write a short report. The report should indicate how transpiration would vary for that week, if the weather report proved correct, due to changes in the weather.
- O Have students draw a graph showing changes in transpiration that would take place over a two month period of time based on weather predictions listed in the Farmer's Almanac.

OBJECTIVE 3

State the formula for respiration.

- O Divide students into teams. Have each team develop a creative way to illustrate the formula for respiration. Every team's creative interpretation will be presented to the entire class. These might involve bringing in posters the team has made, writing information on the chalk board, acting the process out in a skit or whatever the teams develop.

OBJECTIVE 4

Explain the formula for respiration.

O Have students write a brief report explaining the process of respiration.

O Have students develop some type of chart, graph, picture, or model that illustrates how respiration works.

OBJECTIVE 5

State the formula for photosynthesis.

R Show transparency 2 illustrating photosynthesis.

O Have students write a report on how respiration and photosynthesis are interrelated.

O Invite a science teacher or some other "expert" to visit the class and explain photosynthesis.

O Have students discuss the role that photosynthesis plays for the environment.

OBJECTIVE 6

Discuss types of plants based upon their agronomic classification.

O Discuss the concept of classifying plants according to the use made of their crops. Discuss types of plants based upon their agronomic classification.

O Have students write an in depth report on one agronomic classification of plants.

OBJECTIVE 7

Label parts of a legume, grain, and tuber.

R Show transparencies 3-5 illustrating the parts of a legume, grain, and tuber.

O Have students bring dissected and labeled samples of a legume, grain, or tuber to class.

O Discuss the differences between legumes, grains, and tubers and how their differences relate to the conditions under which they are grown.

OBJECTIVE 8

Describe methods of crop improvement.

O Invite your local county extension agent to visit the class and discuss methods of crop improvement.

O Have students discuss what they would consider to be the pros and cons of the various methods for improvement.

O Have students give an oral report to the class on which method of crop improvement they would be most likely to try and why.

OBJECTIVE 9

Define genetic engineering.

O Have the class discuss the concept of genetic engineering.

O Have the students contact the local county extension agent, or OSU, or perform research at the local or school library, and learn about plants that have been recently changed or developed through genetic engineering.

O Have the students write a brief report on the information they learned while researching genetic engineering.

OBJECTIVE 10

Define cloning.

O Have students discuss the concept of cloning.

O Have students bring actual samples, pictures, or reports on plants that are cloned to class.

OBJECTIVE 11

Describe uses of defoliants and growth inhibitors.

O Discuss the use of defoliants and growth inhibitors. Ask students about the benefits and possible negatives of using defoliants and growth inhibitors.

OBJECTIVE 12

Calculate the percent of germination to determine the rate of application. (Assignment Sheet 1)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 13

Present an oral report on a recent development in plant or crop technology. (Assignment Sheet 2)

R See the general instructions for all Assignment Sheets.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.
- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.
- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.
- Describe the rating scale used on the skills test.
- Reteach and retest as necessary.
- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.
- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.
- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.
- Complete the appropriate sections of the Competency Profiles.
- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Hybrid Sorghum Performance Trials in Oklahoma, 1990*, OSU Extension Circular No. 866. Stillwater, OK: Cooperative Extension Service, Oklahoma State University.

OPTIONAL RESOURCES

Publications

- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach*. Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.

UNIT REFERENCES

Publications

- *Biological Science Applications in Agriculture*. Danville, IL: Interstate Publishers, Inc. 1994.
- Boone, Lester V. *Producing Farm Crops*, 4th ed. Danville, IL: Interstate Publishers, Inc., 1991.
- Breece, H. Edward, Harold Hansen, and Thomas A. Hoerner. *Planting: Fundamentals of Machine Operation*, 2nd ed. Moline, IL: Deere & Company, 1975.
- Cooper, Elmer L. *Agriscience: Fundamentals & Applications*. Albany, NY: Delmar Publishers Inc., 1990.
- Ensminger, M. E. and C. G. Olentine, Jr. *Feeds & Nutrition - Complete*, 1st ed. Clovis, CA: The Ensminger Publishing Company, 1978.
- Herren, Ray V. and Roy L. Donahue. *The Agriculture Dictionary*. Albany, NY: Delmar Publishers Inc., 1991.
- Hartmann, Hudson Thomas. *Plant Propagation*. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1975.
- Jacks, L. P. *Basic Principles of Plant Science: A Reference Unit for Teaching Basic Principles of Plant Science in Vocational Agriculture Courses in Mississippi*. Jackson, MS: State Board for Vocational Education, Vocational Agriculture Division.
- Peters, J. A. and T. R. Blackwood. *Source Assessment: Defoliation of Cotton, State of the Art*. Washington, D.C.: U.S. Environmental Protection Agency, 1977.

ASSIGNMENT SHEETS

OBJECTIVE 12

Assignment Sheet 1

(answers are rounded off to the nearest 100th.)

1. 85%
2. 89%
3. 90%
4. 77.5%

OBJECTIVE 13

Assignment Sheet 2

Make sure the student's presentation is:

- about a recent development in plant or crop technology
- well-researched
- well-organized
- well-rehearsed
- complete
- the length of time you assigned

WRITTEN TEST

OBJECTIVE 1

1. C
2. E
3. B
4. D
5. A

OBJECTIVE 2

1. The process by which a living plant releases water vapor into the atmosphere
2. Humidity, wind or other air movement, and temperature
3. When humidity increases, transpiration decreases.
   When humidity decreases, transpiration increases.
4. Rate of transpiration also increases
5. The leaf stoma

OBJECTIVE 3

$C_6H_{12}O_6$ + $6O_2$ ---> $6H_2O$ + $6CO_2$ ^
(sugar) (oxygen) (water) (carbon dioxide)

OBJECTIVE 4

The answer should include the following information:

Respiration is the reversal of the photosynthesis reaction. When oxygen from the air combines with the sugar produced by the plant during photosynthesis, the oxygen "burns" the sugar and converts it into carbon dioxide (which is released into the air as gas) and water.

OBJECTIVE 5

$6CO_2$ + $6H_{12}O$ ---> $C_6H_{12}O_6$ + $6O_2$ ^
(carbon dioxide) (water) (sugar) (oxygen)

OBJECTIVE 6

1. A. As a source for vegetable oil and concentrated protein

   B. The answer must include any two of the following: soybeans, peanuts, sunflowers, safflowers, rapeseed (canola), carambe, or corn (if grown for its oil)

2. A. Cereals are grown for their edible fruit or seed. Grain is grown for seed or grain to be used for food or feed.

   B. The answer must include any two of the following: wheat, barley, rye, oats, or rice

3. A. In some way other than a source of fiber or food for humans or animals

   B. The answer must include both of the following: tobacco and hops

4. A. Primarily for animal or human consumption

   B. The answer must include any two of the following: potatoes, sugar beets, turnips, mangels, carrots, rutabagas, or sweet potatoes

5. A. Sugar production

   B. The answer must include any two of the following: sugar beets, sweet sorghums, sugarcane, or corn grown for fructose

6. A. Livestock feed

   B. Answer must include any two of the following: corn, alfalfa, clovers, lespedeza, birdsfoot trefoil, Kentucky bluegrass, smooth brome grass, orchard grass, tall fescue, Bermuda grass, sorghums, corn, millets, Sudan grass, or various small grains used for hay and pasture

7. A. To provide materials for clothing and shelter

   B. Answer must include any two of the following: cotton, flax, or kenaf

OBJECTIVE 7

Parts of a legume

1. Bud
2. Leaves
3. Node
4. Stem
5. Nodules
6. Roots
7. Petiole
8. Internode

Parts of a grain

1. Growing point
2. Boot
3. Node
4. Crown
5. Tiller

Parts of a tuber

1. Adventitious shoots
2. Distal end
3. Scar
4. Adventitious roots

OBJECTIVE 8

1. Using crops that have already been developed and tested somewhere else.

2. The variety was originally developed in a state with similar soil and climate conditions.

3. Because nothing new has been created. Selections can only be made from existing material.

4. Largely a case of selecting individual plants or heads from an existing crop variety.

5. From the plants that were grown from the seed of the plants chosen as a result of mass selection "after" the new plants are tested for agronomically desirable characteristics.

6. Develop something new instead of just using what already exists.

7. So as to combine disease resistance with a high yielding ability.

OBJECTIVE 9

Genetic engineering is the alteration of an organism's genes through human intervention.

OBJECTIVE 10

Cloning is the act of developing a group of genetically identical plants from a single plant through vegetative means (cuttings, grafting, or layering) rather than seeds.

OBJECTIVE 11

1. Answer must include any three of the following reasons:

   - Helps lodged plants return to an erect position
   - Removes leaves, which--if left--could clog the spindle, add trash to the harvest, and stain the fiber
   - Accelerates the opening of mature bolls
   - Reduces boll rot
   - Reduces populations of insects which feed on leaves, thereby helping to eliminate the damage that insects can cause to the fiber

2. Answer must include any three of the following uses:

   - To prevent lodging of wheat (by shortening the plant stem)
   - To place nursery plants in a state of dormancy during shipping, in order to preserve quality
   - To promote flowering, fruit ripening, and the removal of leaves
   - To make the harvest of tree and vine fruits easier
   - To ripen fruit uniformly before shipping
   - To make cotton harvesting easier by slowing vegetative growth
   - To increase the yield of such plants as cucumbers and pumpkins by stimulating the production of female flowers
   - To slow the ripening process

OBJECTIVE 12 Evaluated on Assignment Sheet 1.

OBJECTIVE 13 Evaluated on Assignment Sheet 2.

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) ***Soil, Plant, and Crop Science***

UNIT NUMBER AND TITLE – D-1 Growth and Reproduction

TOTAL NUMBER OF TEST QUESTIONS 48

TOTAL NUMBER OF BASIC SKILL QUESTIONS 27

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	**1-5**	**S**
2	**1-5**	**W, S**
3	**1**	**X**
4	**1**	**W, S**
5	**1**	**X**
6	**1-7**	**W, S**
7	**1-8; 1-5; 1-4**	**X**
8	**1-7**	**W, S**
9	**1**	**X**
10	**1**	**X**
11	**2**	**S**
12	**Evaluated on AS 1**	
13	**Evaluated on AS 2**	

INSTRUCTOR'S GUIDE

SEEDS AND PLANTS: SELECTION, PREPARATION, AND PLANTING

D-2

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read *Summer Tillage and Seedbed Preparation for Wheat*, OSU Current Report No. 2077.

Writing

R Have students write a short essay (one paragraph to one page) on how summer tillage for wheat is conducted.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1 **Select from a list guidelines for selecting high-quality seed.**

O Invite the local county extension agent to visit and discuss the pitfalls of using less than high-quality seed.

O Have students choose one of the guidelines for selecting seed and write a brief report (about one page) on what could happen if someone bought seed that didn't meet that criteria.

OBJECTIVE 2 **State reasons for tillage.**

O Take students on a field trip to farmland that's been tilled.

O Have students give oral reports on why tillage is used.

OBJECTIVE 3 **Explain the purpose of various tillage systems.**

R Have students read *Evaluation of Lo-Till Demonstrations*, OSU Current Report No. 2900.

O Have students write a short report on *Evaluation of Lo-Till Demonstrations*, OSU Current Report No. 2900.

O Discuss the purpose of the various tillage systems.

OBJECTIVE 4 **Identify common crop seeds.**

O Obtain plant and seed samples from the Oklahoma State University, Department of Agronomy, Ag Hall, Stillwater, OK 74078. For current ordering and price information on the crops judging kit contact the OSU Department of Agronomy.

O Take students on a field trip to a seed store so they can see a big variety of seeds.

O Bring samples of seeds that are shown on the information sheet for this objective to class. Divide students into teams and have each team identify at least five types of seeds.

OBJECTIVE 5 **Identify characteristics of common plants.**

R Show Transparency Masters 1 and 2 illustrating characteristics of plants.

O Bring pictures or samples of plants to class (including shoots in clear containers). Have students identify the type of leaves and roots each plant has.

O Discuss the various characteristics that plants can have.

OBJECTIVE 6 **Choose an appropriate site for a specified crop.**

O Have students write a report on what would be the ideal site for three different crops that are NOT listed on the information sheet for this objective.

O Make up the characteristics of five imaginary fields. List them on the chalkboard. Have students discuss in class the different types of crops that would grow well on each site.

OBJECTIVE 7 **List factors affecting seeding rates.**

O Discuss each factor that affects seeding rates.

OBJECTIVE 8 **Describe methods of planting.**

O Have students develop a poster that illustrates the different methods of planting. They may want to show types of machinery used for each, depict land or climate conditions for each, etc.

O Have students fill three small boxes (about shoe box size) full of dirt and mold the dirt in each box the way a larger field would look after it has undergone one of the methods of planting.

OBJECTIVE 9	**Identify types of seeds. (Assignment Sheet 1)** R See the general instructions for all Assignment Sheets.
OBJECTIVE 10	**Identify types of plants. (Assignment Sheet 2)** R See the general instructions for all Assignment Sheets.
OBJECTIVE 11	**Determine tillage operation and practices. (Assignment Sheet 3)** R See the general instructions for all Assignment Sheets.
OBJECTIVE 12	**Interpret seed tag information. (Assignment Sheet 4)** R See the general instructions for all Assignment Sheets.
OBJECTIVE 13	**Select and prepare seed. (Job Sheet 1)** R See the general instructions for all Job Sheets.
OBJECTIVE 14	**Calibrate planting equipment. (Job Sheet 2)** R See the general instructions for all Job Sheets.
OBJECTIVE 15	**Calibrate a grain drill. (Job Sheet 3)** R See the general instructions for all Job Sheets.
OBJECTIVE 16	**Plant a crop. (Job Sheet 4)** R See the general instructions for all Job Sheets.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.

- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.

- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.

- Describe the rating scale used on the skills test.

- Reteach and retest as necessary.

- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.
- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.
- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.
- Complete the appropriate sections of the Competency Profiles.
- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Evaluation of Lo-Till Demonstrations*. OSU Current Report No. 2900. Stillwater, OK: Cooperative Extension Service, Oklahoma State University.
- *Summer Tillage and Seedbed Preparation for Wheat.* OSU Current Report No. 2077. Stillwater, OK: Cooperative Extension Service, Oklahoma State University.

OPTIONAL RESOURCES

Publications

- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.
- *Oklahoma Soil Fertility Handbook*, 2nd ed. Stillwater, OK: Oklahoma Plant Food Educational Society; Department of Agronomy, Oklahoma State University, 1993.

UNIT REFERENCES

Publications

- Boone, Lester V. *Producing Farm Crops*, 4th ed. Danville, IL: Interstate Publishers, Inc., 1991.

- Breece, H. Edward, Harold Hansen, and Thomas A. Hoerner. *Planting: Fundamentals of Machine Operation*, 2nd ed. Moline, IL: Deere & Company, 1975.

- Buckingham, Frank and Arland W. Pauli. *Tillage: Fundamentals of Machine Operation*, 3rd ed. Moline, IL: Deere & Company, 1975.

- Cooper, Elmer L. *Agriscience: Fundamentals & Applications*. Albany, NY: Delmar Publishers Inc., 1990.

- Harp, Keith and Jim Steward. *Vocational Agriculture II*. Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1986.

- Herren, Ray V. and Roy L. Donahue. *The Agriculture Dictionary*. Albany, NY: Delmar Publishers Inc., 1991.

- *World Book Encyclopedia, 1994 Edition, Volumes 4, 14, 16, 18, and 21*. Chicago, IL: World Book, Inc., a Scott Fetzer Co., 1994.

ASSIGNMENT SHEETS

OBJECTIVE 9

Assignment Sheet 1

1. Certified seed
2. Breeder's seed
3. Registered seed
4. Certified seed
5. Foundation seed
6. Foundation seed
7. Breeder's seed

OBJECTIVE 10

Assignment Sheet 2

1. Grain crops
2. Biennials
3. Annual
4. Forage and pasture crops
5. Cereal crop
6. Oil-seed crops
7. Sugar crops
8. Roots and tubers
9. Perennials
10. Fiber
11. Special crops
12. Winter annuals

OBJECTIVE 11

Assignment Sheet 3

1. Fallow
2. Cleaned the surface of residue by incorporating previous crop residue into the soil soon after harvest
3. Conventional
4. Mulch because it helps to protect the soil from wind, as well as helping to retain water throughout the fallow period
5. The need to use different equipment might make the cost of changing prohibitive.

OBJECTIVE 12

Assignment Sheet 4

1. Oklahoma
2. Alfalfa
3. Liberty
4. .20
5. .01
6. No
7. 75
8. 95
9. Sept. 1995 (9-95)
10. 60 pounds

WRITTEN TEST

OBJECTIVE 1

2, 5, 6, 9, 13, 15, 16, 18

OBJECTIVE 2

Answer must include any five of the following:

- Preparing a seedbed to allow the new crop seed to germinate and grow
- Killing weeds
- Helping to control insects and diseases
- Incorporating at least part of the residue of the previous crop into the soil
- Working other fertilizers into the soil
- Breaking up layers of compacted soil

OBJECTIVE 3

1. Produce, on or in the soil, conditions that resist the erosive efforts of wind, rain, and flowing water

2. To clean the surface of residue by incorporating previous crop residue into the soil soon after the harvest

3. It is used to prepare a seedbed and produce a given crop

4. To leave the soil undisturbed from harvest to seeding

OBJECTIVE 4

1. Clover
2. Blackeye cowpea
3. Alfalfa
4. Cotton
5. Barley
6. Corn
7. Wheat
8. Oats
9. Lespedeza
10. Rye
11. Mungbean
12. Sorghum
13. Soybean

OBJECTIVE 5

1. fibrous
2. monocot
3. taproot
4. whorled dicot

OBJECTIVE 6

1. C
2. B
3. A
4. D
5. E

OBJECTIVE 7

Answer must include all of the following:

- Available moisture
- Fertility of soil
- Germination
- Planting time
- Row spacing
- Planter operation

OBJECTIVE 8

1. Where there is either too much moisture prior to planting or it is desirable to apply irrigation water in furrows between beds

2. Causes tops of the beds or ridges to dry sooner, permitting earlier planting than that which is possible with dry-land; also results in an improved stand, improved germination of the seed, and a quicker emergence of the plants

3. Where rainfall is limited during growing season
4. Collects rainfall that would have otherwise run off the land
5. It is easy to irrigate when soil moisture falls below acceptable levels
6. In areas where the rainfall is sufficient to grow a crop without using any irrigation

OBJECTIVE 9	**Evaluated on Assignment Sheet 1.**
OBJECTIVE 10	**Evaluated on Assignment Sheet 2.**
OBJECTIVE 11	**Evaluated on Assignment Sheet 3.**
OBJECTIVE 12	**Evaluated on Assignment Sheet 4.**
OBJECTIVE 13	**Evaluated on Job Sheet 1.**
OBJECTIVE 14	**Evaluated on Job Sheet 2.**
OBJECTIVE 15	**Evaluated on Job Sheet 3.**
OBJECTIVE 16	**Evaluated on Job Sheet 4.**

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE — **D-2 Seeds and Plants: Selection, Preparation, and Planting**

TOTAL NUMBER OF TEST QUESTIONS 61

TOTAL NUMBER OF BASIC SKILL QUESTIONS 27

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-18	X
2	1-5	X
3	1-4	W, S
4	1-13	S
5	1-4	S
6	1-5	X
7	1-6	X
8	1-6	W, S
9-12	Evaluated on AS 1-4	
13-16	Evaluated on JS 1-4	

INSTRUCTOR'S GUIDE

COMMON PESTS

D-3

Required Activities and Resources (**R**)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (**O**)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read OSU Extension Fact Sheet No. 7183, *The Russian Wheat Aphid in Oklahoma* or No. 7184, *Alfalfa Aphids in Oklahoma.*

Writing

R Have students write a short essay (one page) on one type of aphid and why it is a concern for Oklahoma crop producers.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

Define pest.

O Discuss the term pest. Ask students for examples of what they consider pests.

OBJECTIVE 2

Explain how pests affect plant and crop growth.

O Discuss how pests affect plant and crop growth. Emphasize that there are many ways that pests affect plant and crop growth.

OBJECTIVE 3

Label the stages in the life cycle of common insects.

O Discuss specific insects and their life cycles. Have students write a short paper on a specific insect.

OBJECTIVE 4

Identify types of insect damage.

O Show students examples of the different types of insect damage on various plants.

O Show students examples of chewing and sucking insects. Have students look at the insects under a microscope.

OBJECTIVE 5

Identify insects common to particular crops.

O Obtain the following Oklahoma State University publications and make them available for students to read.

- ☐ F-7150 *Alfalfa Forage Insect Control*
- ☐ F-7156 *Field Key to Larvae in Soybeans*
- ☐ F-7158 *Field Key to Larvae in Peanuts*
- ☐ F-7159 *Field Key to Larvae in Alfalfa*
- ☐ F-7160 *Field Key to Larvae in Corn*
- ☐ F-7161 *Field Key to Larvae in Cotton*
- ☐ F-7162 *Cotton Insect Control in Oklahoma 1988-89*
- ☐ F-7167 *Soybean Insect Survey and Control*
- ☐ F-7168 *Plant Galls Caused by Insects*
- ☐ F-7170 *Control of Sorghum Insects*
- ☐ F-7174 *Peanut Insect Control in Oklahoma*
- ☐ F-7176 *Insects on Small Grains and Their Control*
- ☐ CR-7177 *Scouting for the Alfalfa Weevil in Oklahoma*
- ☐ F-7180 *Stored Grain Insect Control in Oklahoma*
- ☐ F-7183 *Russian Wheat Aphid in Oklahoma*
- ☐ F-7184 *Alfalfa Aphids in Oklahoma*

O Invite a local county extension agent or other crop specialist to speak to the class about insects common to crops.

O Refer to the OSU publication *Annual Extension Agents' Handbook of Insect, Plant Disease and Weed Control* for further information on insects in Oklahoma crops.

OBJECTIVE 6

Identify insect damage in common field crops. (Assignment Sheet 1)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 7

State ways weeds hinder crop production.

O Discuss ways weeds hinder crop production. Ask students why they think it is important for crop producers to get rid of weeds.

OBJECTIVE 8

Identify weeds common to growing area.

O Show students examples of common weeds in your area.

O Refer to the OSU publication *Annual Extension Agents' Handbook of Insect, Plant Disease and Weed Control* for further information on weeds in Oklahoma crops.

OBJECTIVE 9

Identify bird and wildlife damage.

O Show students examples of bird and wildlife damage to plants.

O Obtain OSU Fact Sheet No. F-9001, *Controlling Pocket Gophers* and make it available for students to read.

OBJECTIVE 10

Select from a list indications of plant diseases.

O Bring in examples of plants that show indications of plant diseases. Ask students what indications of diseases the plants show.

OBJECTIVE 11

Match causes of infectious plant diseases to their correct descriptions.

O Obtain OSU Fact Sheet No. F-7612, *Plant Disease Diagnostic Services* and make it available for students to read.

OBJECTIVE 12

Identify diseases in common field crops. (Assignment Sheet 2)

R See the general instructions for all Assignment Sheets.

O Obtain the following Oklahoma State University publications and make them available for students to read.

- ☐ F-7609 *Leaf Rust and Stem Rust of Wheat*
- ☐ F-7622 *Wheat Root Rots*
- ☐ F-7629 *Wheat Soil-Borne Mosaic Virus Disease*
- ☐ F-7631 *Bunt and Loose Smut Disease of Wheat*
- ☐ F-7633 *Powdery Mildew of Wheat*
- ☐ F-7636 *Wheat Streak Mosaic Virus Disease*
- ☐ F-7648 *Stem Nematodes in Alfalfa*
- ☐ F-7649 *Stalk Rot of Sorghum*
- ☐ F-7650 *Fusarium Wilt-Nematode Complex of Cotton*
- ☐ F-7654 *Seedling Disease in Cotton*
- ☐ F-7655 *Foliar Diseases of Peanuts*
- ☐ CR-7656 *Southern Blight Disease Control Demonstrations*

- ⊡ Invite a local county extension agent or other plant disease specialist to talk to the class about plant diseases common in your area.

- ⊡ Refer to the OSU publication *Annual Extension Agents' Handbook of Insect, Plant Disease and Weed Control* for further information on plant diseases in Oklahoma crops.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.

- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.

- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.
- Describe the rating scale used on the skills test.
- Reteach and retest as necessary.
- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.
- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.
- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.
- Complete the appropriate sections of the Competency Profiles.
- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *The Russian Wheat Aphid in Oklahoma.* OSU Extension Fact Sheet No. 7183. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1989.
- *Alfalfa Aphids in Oklahoma.* OSU Extension Fact Sheet No. 7184. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1990.

OPTIONAL RESOURCES

Publications

- *Annual Extension Agents' Handbook of Insect, Plant Disease and Weed Control.* Stillwater, OK: Oklahoma State University Cooperative Extension Service.

- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.

- The following Oklahoma State University publications. Check with your local Extension Office. (F = Fact Sheet, CR = Current Report)

  ☐ F-7150 *Alfalfa Forage Insect Control*
  ☐ F-7156 *Field Key to Larvae in Soybeans*
  ☐ F-7158 *Field Key to Larvae in Peanuts*
  ☐ F-7159 *Field Key to Larvae in Alfalfa*
  ☐ F-7160 *Field Key to Larvae in Corn*
  ☐ F-7161 *Field Key to Larvae in Cotton*
  ☐ F-7162 *Cotton Insect Control in Oklahoma 1988-89*
  ☐ F-7167 *Soybean Insect Survey and Control*
  ☐ F-7168 *Plant Galls Caused by Insects*
  ☐ F-7170 *Control of Sorghum Insects*
  ☐ F-7174 *Peanut Insect Control in Oklahoma*
  ☐ F-7176 *Insects on Small Grains and Their Control*
  ☐ CR-7177 *Scouting for the Alfalfa Weevil in Oklahoma*
  ☐ F-7180 *Stored Grain Insect Control in Oklahoma*
  ☐ F-7183 *Russian Wheat Aphid in Oklahoma*
  ☐ F-7184 *Alfalfa Aphids in Oklahoma*
  ☐ F-7609 *Leaf Rust and Stem Rust of Wheat*
  ☐ F-7612 *Plant Disease Diagnostic Services*
  ☐ F-7622 *Wheat Root Rots*
  ☐ F-7629 *Wheat Soil-Borne Mosaic Virus Disease*
  ☐ F-7631 *Bunt and Loose Smut Disease of Wheat*
  ☐ F-7633 *Powdery Mildew of Wheat*
  ☐ F-7636 *Wheat Streak Mosaic Virus Disease*
  ☐ F-7648 *Stem Nematodes in Alfalfa*
  ☐ F-7649 *Stalk Rot of Sorghum*
  ☐ F-7650 *Fusarium Wilt-Nematode Complex of Cotton*
  ☐ F-7654 *Seedling Disease in Cotton*
  ☐ F-7655 *Foliar Diseases of Peanuts*
  ☐ CR-7656 *Southern Blight Disease Control Demonstrations*
  ☐ F-9001 *Controlling Pocket Gophers*

UNIT REFERENCES

Videos

- *The Russian Wheat Aphid*, VT89. Available for loan through the Oklahoma State University Cooperative Extension Videotape Library. Check with your local Oklahoma County Extension Office.

Publications

- Boone, Lester V. *Producing Farm Crops*. Danville, IL: Interstate Publishers, Inc., 1991.
- *Crop Chemicals*. Moline, IL: John Deere, 1982.
- Delorit, Richard J. et al. *Crop Production*, 5th ed. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1984.
- *Ornamental Pest Management*. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1994.
- Wiseman, A.J.L., et al. *Crop Husbandry*. New York: Permagon Press, 1993.
- The following Oklahoma State University publications. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
  - F-7150 *Alfalfa Forage Insect Control*
  - F-7156 *Field Key to Larvae in Soybeans*
  - F-7158 *Field Key to Larvae in Peanuts*
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  - F-7167 *Soybean Insect Survey and Control*
  - F-7168 *Plant Galls Caused by Insects*
  - F-7170 *Control of Sorghum Insects*
  - F-7174 *Peanut Insect Control in Oklahoma*
  - F-7176 *Insects on Small Grains and Their Control*
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  - F-7180 *Stored Grain Insect Control in Oklahoma*
  - F-7183 *Russian Wheat Aphid in Oklahoma*
  - F-7184 *Alfalfa Aphids in Oklahoma*
  - F-7609 *Leaf Rust and Stem Rust of Wheat*
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☐ F-7631 *Bunt and Loose Smut Disease of Wheat*
☐ F-7633 *Powdery Mildew of Wheat*
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☐ F-7648 *Stem Nematodes in Alfalfa*
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☐ F-7650 *Fusarium Wilt-Nematode Complex of Cotton*
☐ F-7654 *Seedling Disease in Cotton*
☐ F-7655 *Foliar Diseases of Peanuts*
☐ CR-7656 *Southern Blight Disease Control Demonstrations*
☐ F-9001 *Controlling Pocket Gophers*

- *1994 OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control.* Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1994.

ASSIGNMENT SHEETS

OBJECTIVE 6

Assignment Sheet 1

PART 1

1. This type of damage is caused by the insertion of sucking mouthparts and the removal of plant sap and chlorophyll. Aphids are a possible cause.

2. This type of damage is caused by insects that have chewing mouthparts. Grasshoppers are a possible cause.

3. Distortion of plant parts.

4. Scale insects, larvae of boring beetles or moths, and gall wasps.

PART 2

Answers will vary according to the examples of insect damage shown to students.

OBJECTIVE 12

Assignment Sheet 2

PART 1

1. Downy Mildew
2. Leaf Spots
3. Maize Dwarf Mosaic
4. Stalk Rot
5. Seedling Blight
6. Early Leafspot
7. Sclerotinia Blight
8. Covered Smut
9. Streak Mosaic
10. Dryland Root Rot
11. Ergot
12. Leaf Blight
13. Head Smut
14. Powdery Mildew
15. Purple Seed Stain

PART 2

Answers will vary according to the examples of plant diseases shown to students.

WRITTEN TEST

OBJECTIVE 1

A **pest** is any undesirable or destructive organism such as destructive insects, rodents, undesirable bacteria, fungus, and weeds.

OBJECTIVE 2

1. Insects affect the health of a plant by chewing and piercing plant parts causing poor growth and lower crop yields.

2. Weeds affect plant growth by competing with the plant for vital resources, such as sunlight and moisture.

3. Pests that cause plant diseases disrupt normal cell functions, cause poor growth and health, can cause root rots, wilt, and decline or death of the plant.

OBJECTIVE 3

FOUR-STAGE LIFE CYCLE

1. Egg
2. Larva
3. Pupa
4. Adult

THREE-STAGE LIFE CYCLE

1. Egg
2. Nymph
3. Adult

OBJECTIVE 4

1. Insects that have chewing mouthparts such as larvae of moths, butterflies, and sawflies; adult beetles; and grasshoppers.

2. Insertion of sucking mouthparts into the leaf; the plant sap is removed and chlorophyll is withdrawn.

3. Curled or cupped leaves, twisted growing points, or galls.

4. Scale insects, larvae of boring beetles or moths, or gall wasps.

OBJECTIVE 5

1, 3, 4, 6, 8, 10, 11, 12, 14, 16, 18, 19, 21, 22, 23, 24, 25, 27, 28, 30, 31, 33, 34, 35, 36, 38, 39, 41, 42, 43, 45, 46, 47, 50, 51

OBJECTIVE 6

Evaluated on Assignment Sheet 1.

OBJECTIVE 7

Answer should include the following:

- Compete with crop for moisture
- Compete with crop for sunlight
- Compete with crop for soil nutrients
- Harbor insects and diseases
- Promote molding and spoilage in stored grains
- Reduce crop yield
- Reduce crop quality
- Reduce crop value

OBJECTIVE 8

1, 2, 4, 5, 6, 8, 9, 11, 12, 13, 14, 16, 17, 18, 20, 22, 23, 25, 26, 27, 29, 30, 32, 33

OBJECTIVE 9

1. Birds will eat some cereal seeds and can cause damage to young and mature crops of some plants. Generally, birds are more beneficial than harmful. Birds help control insects and some birds eat mice and other rodents.
2. Rabbits eat many growing crops, particularly young cereals.
3. Answer should include any two of the following:
    - Mice damage young plant seedlings and consume seeds.
    - Pocket gophers dig tunnels bringing the soil to the surface and eat the roots of plants.
    - Moles dig tunnels and eat parts of plants.
    - Prairie dogs eat plants and dig burrows.
    - Ground squirrels eat plants.

OBJECTIVE 10	1, 2, 3, 5, 7, 8, 9, 11, 12, 13, 15
OBJECTIVE 11	1. G 2. D 3. F 4. B 5. C
OBJECTIVE 12	**Evaluated on Assignment Sheet 2.**

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE – D-3 Common Pests

TOTAL NUMBER OF TEST QUESTIONS 79

TOTAL NUMBER OF BASIC SKILL QUESTIONS 37

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1	X
2	1-3	S
3	1-7	S
4	1-4	W,S
5	1-51	X
6	Evaluated on AS 1	
7	1-8	X
8	1-33	X
9	1-3	W
10	1-15	S
11	1-5	S
12	Evaluated on AS 2	

INSTRUCTOR'S GUIDE

CONTROLLING PESTS

D-4

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read *Weed Control in Agronomic Crops*, OSU Extension Fact Sheet No. 2751.

Writing

R Have students write a short (one paragraph to one page) essay on weed control in agronomic crops. Have students include a discussion of why they believe the principles listed in the fact sheet are important.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

List methods of controlling plant pests.

O Obtain the following OSU Fact Sheets and make them available for students to read:

☐ CR-2752 *Weed Control in Soybeans*
☐ F-2755 *Bindweed Control in Oklahoma*
☐ F-2758 *Weed Control on Rangeland*
☐ F-2762 *Chemical Weed Control in Cotton*
☐ F-2763 *Chemical Weed Control in Sorghum*
☐ CR-2769 *Weed Control in Corn*
☐ F-2770 *Weed Control in Winter Wheat*
☐ F-2774 *Cheat Control in Wheat*
☐ F-7150 *Alfalfa Forage Insect Control*
☐ F-7167 *Soybean Insect Survey and Control*
☐ F-7170 *Control of Sorghum Insects*
☐ F-7174 *Peanut Insect Control in Oklahoma*
☐ F-7176 *Insects on Small Grains and Their Control*
☐ F-7180 *Stored Grain Insect Control in Oklahoma*
☐ CR-7185 *Foliar Disease Control in Wheat*
☐ F-7186 *Soilborne Blight Diseases of Peanuts*
☐ F-7187 *Viral Diseases of Peanuts*

O Have students make a list of what they think are advantages and disadvantages of each method.

O Refer to the *Annual OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control*, the *Agriculture - Plant Commercial Pesticide Applicator Training Manual*, and *Applying Pesticides Correctly* for further information.

O Discuss the Oklahoma Private Pesticide Applicators license with students. A private applicator includes any person who uses or supervises the use of any restricted use pesticides for purposes of producing an agricultural commodity such as farmers, ranchers, growers, etc. For more information on pesticide application contact:

Pest Management Section
Oklahoma Department of Agriculture
Plant Industry Division
2800 North Lincoln Boulevard
Oklahoma City, OK 73105-4298
(405) 521-3864

Pesticide Coordinator
Oklahoma State University
501 Life Sciences West
Stillwater, OK 74078-0285
(405) 744-5531

OBJECTIVE 2

Name categories of pesticides and the pests they are used on.

R Discuss "general use" and "restricted use" classifications of pesticides. "General use" pesticides may be purchased by the general public and used according to the label directions. "Restricted use" pesticides may only be purchased and applied by certified applicators or individuals working under the direct supervision of a certified applicator.

O Bring example labels from several types of pesticides and make them available for students to read.

OBJECTIVE 3

Discuss the chemical classifications of pesticides.

O Bring example labels from each classification and make them available for students to read.

OBJECTIVE 4

Explain the principles of integrated pest management.

O Discuss the principles of integrated pest management. Ask students why they think an integrated pest management system is important it today's agricultural environment.

O Have students write a paper on integrated pest management. Have students share their findings with the class in a brief (3-5 minute) oral report.

O Obtain OSU publications CR-7179, *Integrated Control of the Alfalfa Weevil* and F-7307, *Beneficial Insects* and make them available for students to read.

O Invite a local county extension agent or other pest management specialist to speak to the class about integrated pest management.

OBJECTIVE 5 **Match methods of applying pesticides to their definitions.**

R Discuss various equipment used to apply both liquid and dry chemicals and the types of formulations used.

- Liquid Chemicals
    - ☐ Hand-operated sprayers
    - ☐ Low-pressure sprayers
    - ☐ High-pressure sprayers
    - ☐ Air carrier sprayers
    - ☐ Foggers and rope wick applicators
- Dry Chemicals
    - ☐ Broadcast applicators
    - ☐ Band applicators
- Liquid Formulations
    - ☐ Emulsifiable concentrates
    - ☐ Solutions
    - ☐ Flowables
    - ☐ Aerosols
    - ☐ Invert emulsions
    - ☐ Fumigants
- Dry Formulations
    - ☐ Dusts
    - ☐ Baits
    - ☐ Granules
    - ☐ Pellets
    - ☐ Wettable powders
    - ☐ Soluble powders
    - ☐ Microencapsulation
    - ☐ Water-dispersable granules

- O Refer to *Applying Pesticides Correctly* for further information. Refer students to the appropriate sections in the publication and make it available for them to read.
- O Discuss the advantages and disadvantages of the various equipment and formulations available. Show students examples of the different formulations and equipment.
- O Refer to the *Annual OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control* and the *Agriculture - Plant Commercial Pesticide Applicator Training Manual* for further information.

OBJECTIVE 6

List factors to consider when choosing a herbicide.

- O Refer to *Applying Pesticides Correctly* for further information. Refer students to the appropriate sections in the publication and make it available for them to read.
- O Refer to the *Annual OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control* and the *Agriculture - Plant Commercial Pesticide Applicator Training Manual* for further information.

OBJECTIVE 7

List factors which determine the effectiveness of a pesticide.

- O Refer to *Applying Pesticides Correctly* for further information. Refer students to the appropriate sections in the publication and make it available for them to read.
- O Refer to the *Annual OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control* and the *Agriculture - Plant Commercial Pesticide Applicator Training Manual* for further information.

OBJECTIVE 8

Describe various biological and cultural control methods.

- O Have students write a paper on either biological or cultural control methods. Students may write about the overall biological or cultural control methods or choose a specific method or topic to write about. Have students share their finding with the class in a brief (3-5 minute) oral report.
- O Refer to *Applying Pesticides Correctly* for further information. Refer students to the appropriate sections in the publication and make it available for them to read.

OBJECTIVE 9

Select appropriate methods of pest control. (Assignment Sheet 1)

R See the general instructions for all Assignment Sheets.

O Refer to the *Annual OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control*, the *Agriculture - Plant Commercial Pesticide Applicator Training Manual*, and *Applying Pesticides Correctly* for further information.

OBJECTIVE 10

Interpret information on a pesticide label. (Assignment Sheet 2)

R See the general instructions for all Assignment Sheets.

R Use Handout 1 *Reading a Pesticide Label* to help students complete this Assignment Sheet.

OBJECTIVE 11

Select appropriate pesticide category. (Assignment Sheet 3)

R See the general instructions for all Assignment Sheets.

O Refer to the *Annual OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control*, the *Agriculture - Plant Commercial Pesticide Applicator Training Manual*, and *Applying Pesticides Correctly* for further information.

OBJECTIVE 12

Determine application rates. (Assignment Sheet 4)

R See the general instructions for all Assignment Sheets.

O Refer to the *Annual OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control*, the *Agriculture - Plant Commercial Pesticide Applicator Training Manual*, and *Applying Pesticides Correctly* for further information.

OBJECTIVE 13

Calculate pesticide costs. (Assignment Sheet 5)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 14

Calibrate a sprayer. (Job Sheet 1)

R See the general instructions for all Job Sheets.

O Obtain the following OSU Fact Sheets and make them available for students to read:

- F-1215 *Selecting the Proper Nozzle Type and Size*
- F-1216 *Calibrating a Low Pressure Ground Sprayer*
- F-1217 *The Low Pressure Ground Sprayer*
- F-1218 *Pumps for Low Pressure Ground Sprayer*

O Refer to the *Annual OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control*, the *Agriculture - Plant Commercial Pesticide Applicator Training Manual*, and *Applying Pesticides Correctly* for further information.

OBJECTIVE 15

Apply pesticide. (Job Sheet 2)

R See the general instructions for all Job Sheets.

R Consult with your local school administration before allowing students to handle any potential hazardous chemicals. Unless an individual has a private applicator license do NOT let them use pesticides. Instructors may choose to simulate applying pesticides by using non-toxic substances such as water.

R Make sure that students have the appropriate protective clothing and equipment before applying any pesticide.

O Refer to the *Annual OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control*, the *Agriculture - Plant Commercial Pesticide Applicator Training Manual*, and *Applying Pesticides Correctly* for further information.

OBJECTIVE 16

Clean pesticide equipment. (Job Sheet 3)

R See the general instructions for all Job Sheets.

R Consult with your local school administration before allowing students to handle any potential hazardous chemicals. Unless an individual has a private applicator license do NOT let them use pesticides. Instructors may choose to simulate cleaning pesticide equipment by using non-toxic substances such as water.

O Refer to the *Annual OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control*, the *Agriculture - Plant Commercial Pesticide Applicator Training Manual*, and *Applying Pesticides Correctly* for further information.

OBJECTIVE 17

Dispose of chemical containers. (Job Sheet 4)

R See the general instructions for all Job Sheets.

R Consult with your local school administration before allowing students to handle any potential hazardous chemicals. Unless an individual has a private applicator license do NOT let them use pesticides. Instructors may choose to simulate disposing of pesticide containers by using non-toxic substances such as water.

O Refer to the *Annual OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control*, the *Agriculture - Plant Commercial Pesticide Applicator Training Manual*, and *Applying Pesticides Correctly* for further information.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.

- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.
- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.
- Describe the rating scale used on the skills test.
- Reteach and retest as necessary.
- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.
- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.
- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.
- Complete the appropriate sections of the Competency Profiles.
- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Weed Control in Agronomic Crops.* OSU Extension Fact Sheet No. 2751. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1990.
- *Insects on Small Grains and Their Control.* OSU Extension Fact Sheet No. 7176. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1993.

  ☑ **NOTE:** For information on obtaining these publications contact your local Oklahoma county extension office.

OPTIONAL RESOURCES

Publications

- *Agriculture – Plant: Commercial Pesticide Applicator Training Manual.* Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1993.
- *Applying Pesticides Correctly.* Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1992.
- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.
- *1994 OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control.* Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1994.
- The following Oklahoma State University publications. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
  - ☐ CR-2752 *Weed Control in Soybeans*
  - ☐ F-2755 *Bindweed Control in Oklahoma*
  - ☐ F-2758 *Weed Control on Rangeland*
  - ☐ F-2762 *Chemical Weed Control in Cotton*
  - ☐ F-2763 *Chemical Weed Control in Sorghum*
  - ☐ CR-2769 *Weed Control in Corn*
  - ☐ F-2770 *Weed Control in Winter Wheat*
  - ☐ F-2774 *Cheat Control in Wheat*
  - ☐ F-7150 *Alfalfa Forage Insect Control*

- ☐ F-7167 *Soybean Insect Survey and Control*
- ☐ F-7170 *Control of Sorghum Insects*
- ☐ F-7174 *Peanut Insect Control in Oklahoma*
- ☐ F-7176 *Insects on Small Grains and Their Control*
- ☐ F-7180 *Stored Grain Insect Control in Oklahoma*
- ☐ CR-7185 *Foliar Disease Control in Wheat*
- ☐ F-7186 *Soilborne Blight Diseases of Peanuts*
- ☐ F-7187 *Viral Diseases of Peanut*
- ☐ F-1215 *Selecting the Proper Nozzle Type and Size*
- ☐ F-1216 *Calibrating a Low Pressure Ground Sprayer*
- ☐ F-1217 *The Low Pressure Ground Sprayer*
- ☐ F-1218 *Pumps for Low Pressure Ground Sprayer*
- ☐ CR-7179 *Integrated Control of the Alfalfa Weevil*
- ☐ F-7307 *Beneficial Insects*

☑ **NOTE:** Contact your local Oklahoma county extension office for information on OSU publications.

UNIT REFERENCES

Publications

- *Agriculture – Plant: Commercial Pesticide Applicator Training Manual.* Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1993.
- *Applying Pesticides Correctly*. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1992.
- Boone, Lester V. *Producing Farm Crops*. Danville, IL: Interstate Publishers, Inc., 1991.
- Cobb, Andrew. *Herbicides and Plant Physiology*. New York: Chapman & Hall, 1992.
- Cremlyn, R.J. *Agrochemicals: Preparation and Mode of Action.* New York: John Wiley & Sons, 1991.
- *Crop Chemicals*. Moline, IL: John Deere, 1982.
- Delorit, Richard J. et al. *Crop Production*, 5th ed. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1984.
- Green, M.B., et al. *Chemicals for Crop Improvement and Pest Management, 3rd ed.* New York: Pergamon Press, 1987.
- Haskell, P.T. *Pesticide Application: Principles and Practice.* New York: Oxford University Press, 1985.

- *Ornamental Pest Management.* Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1994.

- Wiseman, A.J.L., et al. *Crop Husbandry.* New York: Permagon Press, 1993.

- The following Oklahoma State University publications. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

    - □ F-7150 *Alfalfa Forage Insect Control*
    - □ F-7162 *Cotton Insect Control in Oklahoma 1988-89*
    - □ F-7167 *Soybean Insect Survey and Control*
    - □ F-7170 *Control of Sorghum Insects*
    - □ F-7174 *Peanut Insect Control in Oklahoma*
    - □ F-7176 *Insects on Small Grains and Their Control*
    - □ CR-7177 *Scouting for the Alfalfa Weevil in Oklahoma*
    - □ F-7180 *Stored Grain Insect Control in Oklahoma*
    - □ CR-7656 *Southern Blight Disease Control Demonstrations*

- *1994 OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control.* Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1994.

ASSIGNMENT SHEETS

OBJECTIVE 9

Assignment Sheet 1

1. A small black wasp which is a native parasite of the greenbug and the lady beetle may reduce greenbug populations. Chemical controls should be used when the pest population reaches economic levels and will impair the quality and quantity of the crop.
2. Yes
3. The producer can take preventive measures such as plowing wheat stubble as early as possible, destroying volunteer wheat as soon as it sprouts, planting wheat after safe-seeding date, and planting resistant varieties of wheat.
4. No; the producer should not take action unless the pest problem will affect the quality and quantity of the crop.
5. The control should include crop rotation and delayed sowing in the fall.
6. Treating the seed before planting
7. No; the producer should evaluate the pest problem and also other methods of control before using chemical controls.

OBJECTIVE 10

Assignment Sheet 2

Student answers will vary according to the pesticide label given by the instructor.

OBJECTIVE 11

Assignment Sheet 3

1. insecticide
2. herbicide
3. herbicide
4. fungicide
5. fungicide
6. nematicide
7. herbicide
8. fungicide
9. acaricide
10. insecticide

OBJECTIVE 12

Assignment Sheet 4

GPA for broadcast application = 189.75

GPA for band application = 316.25

OBJECTIVE 13

Assignment Sheet 5

Student answers will vary according to the pesticide cost and size of field given.

WRITTEN TEST

OBJECTIVE 1

Answer should include the following in any order:

- Resistant varieties of plants
- Biological control
- Cultural control
- Mechanical control
- Sanitation
- Chemical control

OBJECTIVE 2

Answer should include the following in any order:

- **insecticides** – control insects
- **fungicides** – control fungus diseases
- **herbicides** – control weeds
- **nematicides** – control nematodes
- **rodenticides** – control rodents such as rats and mice
- **acaricides** – control mites

OBJECTIVE 3

1. Pesticides that are made from minerals
2. Synthetic organic pesticides
3. Viruses, bacteria, and fungi which are cultured in a laboratory
4. Plant-derived organic pesticides

OBJECTIVE 4

1. To achieve the best possible system of crop management
2. Improved decision making
3. Management strategies such as resistant varieties of plants, biological controls, and cultural controls.
4. Answer should include any two of the following:
   - ☐ increased yields through improved crop management practices
   - ☐ decrease in production costs through using other pest management strategies
   - ☐ decrease in the chance of the potential development of pesticide resistant strains and development of secondary pests
   - ☐ decrease in the possibility of environmental contamination because of the informed use of pesticides
   - ☐ conservation of energy when natural controls are used and chemical control is reduced

OBJECTIVE 5

1. L
2. P
3. M
4. R
5. E
6. B
7. G
8. D
9. K
10. I
11. A
12. J
13. S

OBJECTIVE 6

Answer should include the following:

- Effectiveness and safety to the crop
- Herbicide must be registered for the intended use
- Availability
- Cost
- Application method
- Environmental concerns
- Toxicity
- Soil type
- Subsequent operations in the field

OBJECTIVE 7

Answer should include the following:

- Plant factors
- Application of the pesticide
- Rainfall
- Temperature
- Wind
- Soil texture and organic matter

OBJECTIVE 8

1. Predators and parasites are organisms which attack insect pests in their native environment, are imported or produced in laboratories, and are then released in infested areas.
2. Pathogens are parasitic bacteria, viruses, and fungi that are introduced into infested crops and control insects by introducing diseases. The disease agents may be naturally occurring and also are imported or produced in laboratories.
3. Release of sterile males
4. An insect pheromone is identified and synthetically produced and then used to disrupt the behavior of a particular insect. Pheromones may be used to alter the reproductive patterns or attract insects into a trap.
5. Juvenile hormones
6. Crops which attract pests that are planted early or nearby to attract pests away from the main crop. The trap crop is destroyed at a time that will break the reproductive cycle of the pest.
7. Crop rotation includes taking infested fields out of production and either leaving them fallow or planting a different crop.
8. Delaying planting of crops may reduce the pest population by depriving the pest of the host plant needed for food and reproduction when the pest population is most abundant.
9. As soon as they are mature

OBJECTIVE 9	**Evaluated on Assignment Sheet 1.**
OBJECTIVE 10	**Evaluated on Assignment Sheet 2.**
OBJECTIVE 11	**Evaluated on Assignment Sheet 3.**
OBJECTIVE 12	**Evaluated on Assignment Sheet 4.**
OBJECTIVE 13	**Evaluated on Assignment Sheet 5.**
OBJECTIVE 14	**Evaluated on Job Sheet 1.**
OBJECTIVE 15	**Evaluated on Job Sheet 2.**
OBJECTIVE 16	**Evaluated on Job Sheet 3.**
OBJECTIVE 17	**Evaluated on Job Sheet 4.**

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE – **D-4 Controlling Pests**

TOTAL NUMBER OF TEST QUESTIONS **57**

TOTAL NUMBER OF BASIC SKILL QUESTIONS **17**

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-6	X
2	1-6	X
3	1-4	S
4	1-4	W, S
5	1-13	X
6	1-9	X
7	1-6	X
8	1-9	W, S
9	Evaluated on AS 1	
10	Evaluated on AS 2	
11	Evaluated on AS 3	
12	Evaluated on AS 4	
13	Evaluated on AS 5	
14	Evaluated on JS 1	
15	Evaluated on JS 2	
16	Evaluated on JS 3	
17	Evaluated on JS 4	

INSTRUCTOR'S GUIDE

NATIVE AND IMPROVED PASTURES

D-5

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read *Differences Between Range and Introduced Pasture Management*, OSU Extension Facts No. 2867.

Writing

R Have students write a short essay (one page) on the differences between range and introduced pasture management. Have students include a discussion of why they believe it is important to have both native and introduced pastures.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

Select from a list factors affecting pasture management.

O Have students write a short paragraph on each factor explaining in what way they think it affects pasture management.

OBJECTIVE 2

Name factors that affect forage growth.

O Have students observe forage growth in several areas around your local area. Have students write a short description of the forage growth and how they think the factors may be affecting the growth.

OBJECTIVE 3

List practices that improve grazing.

O Obtain *Using Prescribed Fire in Oklahoma*, OSU Extension Fact Sheet F-2865 and make it available for students to read.

O Invite a local county extension agent or other pasture management specialist to talk to the class about improving grazing.

O Refer to *Range Development and Improvements* for further information on improving rangelands.

OBJECTIVE 4

Define animal unit.

O Obtain *Determining Native Range Stocking Rates*, OSU Extension Facts No. 2855 and make it available for students to read.

OBJECTIVE 5 **Match grasses to their degree of palatability.**

O Have students interview a local livestock rancher about the types of grasses in his or her pastures and how the livestock eat the grass.

OBJECTIVE 6 **Complete a chart listing characteristics of native grasses.**

O Have students make a list of native grasses common to your area.

O Refer to *Pasture and Range Plants* for further information.

O Show the videos *Grass Identification I* and *Grass Identification II.*

OBJECTIVE 7 **List ways to prevent overgrazing.**

OBJECTIVE 8 **Describe different grazing systems.**

O Have students determine the stocking rates of area livestock ranchers.

O Have students interview a local livestock rancher and find out what type of grazing system he or she uses, any problems with grazing they might have, and how the rancher took care of the problems.

O Obtain *Determining Native Range Stocking Rates*, OSU Extension Facts No. 2855; *Short Duration Grazing on Native Range*, OSU Extension Facts No. 2580; and *Forage Planning Guidelines*, OSU Extension Facts No. 2584 and make them available for students to read.

OBJECTIVE 9 **Match range sites to their description.**

R Discuss rangeland areas of the United States using Handout 1. Refer to *Our Soils and Their Management* for further information.

O Have students research the controversy surrounding rangeland use in the western United States. Have students write a short report on their findings.

O Have students share their findings with the class in a brief (3-5 minute) oral report.

O Obtain *Grazing Forest Range in Eastern Oklahoma* and make it available for students to read.

- Have students write a report on a type or species of wildlife that's habitat is native range.

OBJECTIVE 10

Match degrees of pasture utilization to their description.

- Have students observe several pastures in your local area and determine their degree of utilization.

OBJECTIVE 11

Select from a list advantages of improved pastures.

- Have students observe an improved pasture in your local area and write a short description of the pasture.

OBJECTIVE 12

Complete a chart of important forage grasses.

- Obtain *Bermudagrass for Grazing or Hay*, OSU Extension Facts No. 2587; *Bermudagrass Varieties for Oklahoma*, OSU Extension Facts No. F-2583; and *Production and Management of Old World Bluestems*, OSU Extension Facts No. 3020 and make them available for students to read.
- Show the videos *Grass Identification I* and *Grass Identification II*.
- Have students make a list of grasses common to your area.
- Refer to *Pasture and Range Plants* and *Forages: The Science of Grassland Agriculture* for further information.

OBJECTIVE 13

Complete a chart of important forage legumes.

- Show the video *Legume and Wood Plants*.
- Have students make a list of legumes common to your area.
- Obtain *Pasture Legumes for Oklahoma*, OSU Extension Facts No. 2585 and make it available for students to read.
- Refer to *Pasture and Range Plants* and *Forages: The Science of Grassland Agriculture* for further information.

OBJECTIVE 14 **State the advantages of renovating pasture land.**

OBJECTIVE 15 **Write six steps for renovating pasture land.**

O Have students compare two pastures from similar areas, one of which has been renovated and one which has not been renovated. Have students write the differences between the pastures.

O Invite a local county extension agent or other knowledgeable person to speak about pasture renovation.

OBJECTIVE 16 **Identify collected rangeland plants. (Assignment Sheet 1)**

R See the general instructions for all Assignment Sheets.

OBJECTIVE 17 **Survey a native rangeland. (Assignment Sheet 2)**

R See the general instructions for all Assignment Sheets.

OBJECTIVE 18 **Survey a pasture to recommend improvement practices. (Assignment Sheet 3)**

R See the general instructions for all Assignment Sheets.

OBJECTIVE 19 **Calculate the cost of establishing an improved pasture management program. (Assignment Sheet 4)**

R See the general instructions for all Assignment Sheets.

O Use the OSU publication on custom rates.

EVALUATION **Pretest**

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.
- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.

- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.

- Describe the rating scale used on the skills test.

- Reteach and retest as necessary.

- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.

- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.

- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.

- Complete the appropriate sections of the Competency Profiles.

- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Differences Between Range and Introduced Pasture Management*, OSU Extension Facts No. 2867. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

OPTIONAL RESOURCES

Publications

- *Bermudagrass for Grazing or Hay*, OSU Extension Facts No. 2587. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1991.
- *Bermudagrass Varieties for Oklahoma*, OSU Extension Facts No. F-2583. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1993.
- *Determining Native Stocking Rates*, OSU Extension Facts No. 2855. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1984.
- Donahue, Roy L., et. al. *Our Soils and Their Management*. Danville, IL: Interstate Publishers, Inc., 1990.
- *Forage Planning Guidelines*, OSU Extension Facts No. 2584. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1991.
- Heath, Maurice, Robert Barnes, and Darrel Metcalfe, editors. *Forages: The Science of Grassland Agriculture*. Ames, Iowa: Iowa State University Press, 1985.
- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach*. Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.

- *Pasture and Range Plants.* Hays, KS: Fort Hays State University, 1989.

- *Pasture Legumes for Oklahoma,* OSU Extension Facts No. 2585. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1991.

- *Production and Management of Old World Bluestems,* OSU Extension Facts No. 3020. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1993.

- *Short Duration Grazing on Native Range,* OSU Extension Facts No. 2580. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1991.

- *Using Prescribed Fire in Oklahoma,* Circular E-927. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1993.

- Vallentine, John F. *Range Development and Improvements,* 3rd ed. New York: Academic Press, Inc., 1989.

Videos

- *Grass Identification I* and *Grass Identification II.* Lubbock, TX: Creative Educational Video.

- *Legume and Wood Plant.* Lubbock, TX: Creative Educational Video.

☑ **NOTE:** For ordering information on these videos contact the Oklahoma Department of Vocational and Technical Education 1-800-522-5810.

UNIT REFERENCES

Publications

- *Determining Native Stocking Rates,* OSU Extension Facts No. 2855. Stillwater, OK: Oklahoma State University Cooperative Extension Service, 1984.

- Delorit, Richard J. *Crop Production.* Englewood Cliffs, NJ: Prentice-Hall, Inc, 1984.

- *Differences Between Range and Introduced Pasture Management,* OSU Extension Facts No. 2867. Stillwater, OK: Oklahoma State University Cooperative Extension Service,

- Donahue, Roy L., et. al. *Our Soils and Their Management.* Danville, IL: Interstate Publishers, Inc., 1990.
- Heath, Maurice, Robert Barnes, and Darrel Metcalfe, editors. *Forages: The Science of Grassland Agriculture.* Ames, Iowa: Iowa State University Press, 1985.
- *Pasture and Range Plants.* Hays, KS: Fort Hays State University, 1989.
- Vallentine, John F. *Range Development and Improvements,* 3rd ed. New York: Academic Press, Inc., 1989.

ASSIGNMENT SHEETS

OBJECTIVE 16

Assignment Sheet 1

Student answers will vary. Students should collect a minimum number of rangeland plants as specified by the instructor.

OBJECTIVE 17

Assignment Sheet 2

Student answers will vary. Students should complete all questions.

OBJECTIVE 18

Assignment Sheet 3

Student answers will vary. Students should complete all questions.

OBJECTIVE 19

Assignment Sheet 4

Answers will vary according to current costs.

WRITTEN TEST

OBJECTIVE 1

1, 3, 5, 7, 8

OBJECTIVE 2

Answer should include any five of the following:

- Rainfall
- Sunlight
- Temperature
- Nutrients in the soil
- Texture of the soil
- Structure of the soil
- Topography

OBJECTIVE 3

Answer should include any six of the following:

- Prescribed burning (controlled burning)
- Herbicides
- Mechanical treatments
- Reseeding
- Fertilizing
- Erosion control
- Water development
- Fencing

OBJECTIVE 4

Animal unit is one mature cow (1,000-pound or 454-kilogram) or its equivalent based upon demand for forage of 26 pounds (12 kilograms) of dry matter forage per day.

OBJECTIVE 5

1. C
2. A
3. B
4. B
5. B
6. C
7. A
8. A
9. B
10. A

OBJECTIVE 6

1. Little bluestem
2. Perennial
3. Good
4. Perennial
5. Increaser
6. Warm
7. Bluegrama
8. Short grass; sod-forming; usually no more than 5 inches tall; seed is produced in small hard burs; much of the plant will remain even with close grazing
9. Cool
10. Increaser
11. Annual
12. Poor

OBJECTIVE 7

Answer should include the following:

- Rotate grazing.
- Use appropriate stocking rates.
- Defer grazing during times of early growth and seed production periods.
- Leave enough forage seed on the area to allow for reproduction needs of the forage.

OBJECTIVE 8

Answer should include the following in any order:

- **Continuous grazing** – grazing of a specific pasture throughout a season or a year
- **Rotational grazing** – system of heavy stocking followed by periods of no grazing so that the pasture forage is allowed to recover and grow again during the same season

- **Deferred grazing** – delaying the start of grazing to allow the pasture forage adequate time to provide for plant reproduction, establishment of new plants, or increased plant vigor

- **Stockpiling of forage** – accumulation of forage in the field during periods of good growth for use during periods of little or no growth

OBJECTIVE 9

1. B
2. I
3. G
4. A
5. F
6. L
7. E
8. J
9. H

OBJECTIVE 10

1. H
2. G
3. A
4. D
5. C

OBJECTIVE 11

1, 3, 5, 6, 7

OBJECTIVE 12

1. Sandy soils near coastal areas
2. Bermuda grass
3. Warm
4. Johnson grass
5. Pasture and lawn grass
6. Cool
7. Southeastern United States and upper Pacific coast
8. Redtop
9. Reducing soil erosion; pasture, hay, and silage
10. Wide variety of soils
11. Tall fescue
12. Clay and clay loams; does poorly on sandy soils
13. Early pasture, soil conservation
14. Early season forage, soil erosion control
15. Old World Bluestems

OBJECTIVE 13

1. Fertile soil with good surface and internal drainage, nonacid
2. Hay, pasture, and silage; usually mixed
3. Annual lespedeza
4. Growing plant resembles alfalfa; seeds are produced in long slender pods; drought resistant
5. Pasture
6. Winter pasture
7. Crownvetch
8. Does well in both sandy and clay soils
9. Perennial
10. Pink flowers; there are several cultivars; not as widely used as many other crops; does not cause bloat
11. Southern United States
12. Biennial
13. Throughout the United States; does best when cool, moist conditions prevail during the growing period
14. Pasture

OBJECTIVE 14

Answer should include the following:

- Reduces competition of other plants
- Provides for more available nutrients
- Increases movement of air and water

OBJECTIVE 15

Answer should include the following:

1. Select the site to be renovated.
2. Prepare the site to be renovated.
3. Test the soil to determine nutrient deficiencies and then apply nutrients with timeliness and accuracy.
4. Choose the appropriate seeding mixture and plant at the correct time on a firm seedbed.
5. Use an integrated pest management system to control troublesome weeds, brush, and insects.
6. Manage the site by supplying adequate lime and fertilizers, monitoring grazing, and renovating when yields decrease substantially.

OBJECTIVE 16

Evaluated on Assignment Sheet 1.

OBJECTIVE 17	**Evaluated on Assignment Sheet 2.**
OBJECTIVE 18	**Evaluated on Assignment Sheet 3.**
OBJECTIVE 19	**Evaluated on Assignment Sheet 4.**

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) ***Soil, Plant, and Crop Science***

UNIT NUMBER AND TITLE — D-5 Native and Improved Pastures

TOTAL NUMBER OF TEST QUESTIONS **110**

TOTAL NUMBER OF BASIC SKILL QUESTIONS **61**

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	**1-8**	**X**
2	**1-5**	**X**
3	**1-6**	**X**
4	**1**	**W**
5	**1-10**	**X**
6	**1-12**	**S**
7	**1-4**	**X**
8	**1-4**	**W**
9	**1-9**	**S**
10	**1-5**	**X**
11	**1-8**	**X**
12	**1-15**	**S**
13	**1-14**	**S**
14	**1-3**	**X**
15	**1-6**	**W,S**
16-19	**Evaluated on AS 1-4**	

INSTRUCTOR'S GUIDE

HARVESTING

D-6

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Have students read *Combine Operation: Measuring Loss*, OSU Extension Facts No. 1225.

Writing

R Have students write a short essay on why it is important for producers to minimize losses.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

Explain the importance of harvesting efficiently.

O Invite one or more producers or other knowledgeable individuals to discuss harvesting with the class.

O Obtain OSU Fact Sheets F-1224, *Combine Operation-Reduce Combine Losses*; F-1225, *Combine Operation-Measuring Loss;* F-1226, *Combine Operation-Adjustment Indicators*; and F-1227, *Combine Operation-Loss Monitors* and make them available for students to read.

OBJECTIVE 2

Identify types of hand harvesting equipment.

O Have students write a short report comparing hand harvesting with power harvesting.

O Have students write a short report on a country or region of a country where hand harvesting is still commonplace. Have students share their findings with the class.

OBJECTIVE 3

Name types of power harvesting equipment.

O Have students visit a local equipment dealer and observe the equipment used for harvesting crops.

O Have students look through current agricultural publications or dealer brochures to find out more about power harvesting equipment.

OBJECTIVE 4 **Select from a list factors to consider when determining correct harvest times.**

O Have students choose one crop and have them write a short paragraph on determining correct harvest times of that crop.

OBJECTIVE 5 **Match common field crops to their average harvesting rate.**

O Have students write a short report comparing current average harvesting rates with historical rates. Have students include a discussion of why they believe harvesting rates have increased.

O Have students research harvesting rates of common crops in your area.

☑ **NOTE:** For information and publications on Oklahoma agricultural statistics contact Oklahoma Agricultural Statistics Service, 2800 N. Lincoln Blvd., Oklahoma City, OK 73105, phone (405) 525-9226.

OBJECTIVE 6 **Complete statements about harvesting specialty crops.**

O Have students research specialty crops grown in your area. Students may interview specialty crop producers and find out information about specialty crops such as harvesting and marketing operations.

O Divide the class into small groups. Have each group brainstorm and come up with a list of specialty crops. Have students discuss where the crops might be marketed and possible problems with production.

OBJECTIVE 7 **Survey harvesting methods for two crops in your region. (Assignment Sheet 1)**

R See the general instructions for all Assignment Sheets.

OBJECTIVE 8 **Determine costs of harvesting crops. (Assignment Sheet 2)**

R See the general instructions for all Assignment Sheets.

OBJECTIVE 9

Determine correct harvest times. (Assignment Sheet 3)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 10

Determine storage methods of harvested crops. (Assignment Sheet 4)

R See the general instructions for all Assignment Sheets.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.

- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.

- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.

- Describe the rating scale used on the skills test.

- Reteach and retest as necessary.
- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.
- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.
- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.
- Complete the appropriate sections of the Competency Profiles.
- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Combine Operation: Measuring Loss*, OSU Extension Facts No. 1225. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

OPTIONAL RESOURCES

Publications

- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.

Videos

- *Farm Implements III: Pre-Harvest and Harvest.* Lubbock, TX: Creative Educational Video. For ordering information call 800-522-5810.

UNIT REFERENCES

Publications

- Delorit, Richard J. et. al. *Crop Production*, 5th ed. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1984.
- *Hay and Forage Harvesting.* Moline, IL: John Deere & Company, 1987.
- Lovegrove, H.T. *Crop Production Equipment.* New York: Hutchinson Technical Education, 1968.
- McKinley, Marvin. *Wheels of Farm Progress.* St. Joseph, MI: American Society of Agricultural Engineers, 1980.
- *New Crops, New Uses, New Markets: 1992 Yearbook of Agriculture.* Washington, DC: Office of Publishing and Visual Communication, U.S. Department of Agriculture, 1992. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
- Partridge, Michael. *Farm Tools through the Ages.* Boston, MA: New York Graphic Society, 1973.
- Quick, Graeme R. and Wesley F. Buchele. *The Grain Harvesters.* St. Joseph, MI: American Society of Agricultural Engineers, 1978.
- Scott, Walter O. and Samuel R. Aldrich. *Modern Soybean Production.* Champaign, IL: S & A Publications, Inc., 1983.

- Shippen, J.M., et. al. *Basic Farm Machinery*, 3rd ed. New York: Permagon Press, 1980.
- Smith, Harris Pearson and Lambert Henry Wilkes. *Farm Machinery and Equipment*, 6th ed. New York: McGraw-Hill Book Company, 1976.

ASSIGNMENT SHEETS

OBJECTIVE 7

Assignment Sheet 1

Student answers will vary. Students should answer each question.

OBJECTIVE 8

Assignment Sheet 2

Student answers will vary. Students should determine the cost of harvesting one crop.

OBJECTIVE 9

Assignment Sheet 3

Student answers will vary.

OBJECTIVE 10

Assignment Sheet 4

Student answers will vary.

WRITTEN TEST

OBJECTIVE 1

1. The percentage of crop lost in harvesting
2. Preharvest losses - losses which are generally weather related
   Machine losses - losses caused by improperly adjusted equipment
3. Crops that are harvested inefficiently or carelessly
4. The crops must be harvested.

OBJECTIVE 2

1. Sickle
2. Scythe

OBJECTIVE 3

Answer should include the following in any order:

- Balers
- Forage harvester
- Combine harvester
- Cotton picker
- Cotton stripper

OBJECTIVE 4

1, 3, 4

OBJECTIVE 5

1. I
2. E
3. H
4. D
5. M
6. N
7. J
8. C
9. A
10. L
11. G

OBJECTIVE 6

1. labor
2. marketed
3. specialized
4. harvested
5. harvested

OBJECTIVE 7

Evaluated on Assignment Sheet 1.

OBJECTIVE 8

Evaluated on Assignment Sheet 2.

OBJECTIVE 9

Evaluated on Assignment Sheet 3.

OBJECTIVE 10

Evaluated on Assignment Sheet 4.

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE – D-6 Harvesting

TOTAL NUMBER OF TEST QUESTIONS 32

TOTAL NUMBER OF BASIC SKILL QUESTIONS 4

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-4	W
2	1-2	X
3	1-5	X
4	1-5	X
5	1-11	X
6	1-5	X
7	Evaluated on AS 1	
8	Evaluated on AS 2	
9	Evaluated on AS 3	
10	Evaluated on AS 4	

INSTRUCTOR'S GUIDE

MARKETING CROPS AND GRADES

E-1

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Read *Marketing Challenge in Oklahoma's Produce Industry: Grower Perspective*, OSU Extension Facts No. 513.

Writing

R Have the students write a short essay (one paragraph to one page) on one aspect of marketing produce.

GENERAL INSTRUCTIONS

Assignment Sheets

R Review the directions and any specific guidelines.

R Make certain that any needed materials from the Instructor's Resource Package are available.

R Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.

R Complete each student's Competency Profile.

O Have the students volunteer to read aloud the directions and any special guidelines.

O Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

R Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.

R Review and explain all general guidelines, safety cautions, and warnings.

R Make sure that all tools, equipment, and supplies are available.

R Demonstrate each of the procedures outlined in the Job Sheet.

R Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.

R Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.

R Complete each student's Competency Profile.

R Return the completed Job Sheets to the students so that they may use them for later reference if needed.

O Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

Describe variables that make up the marketing process.

O Have students write a brief report on how one variable affects the marketing process for farmers.

O Invite the county extension agent to talk to the class about variables that make up the marketing process.

OBJECTIVE 2

Complete statement about factors that add dollars to the marketing cost of products.

O Divide students into teams. Have each team monitor the media for advertising on one particular food product. Once each team has identified a specific campaign they should contact local newspapers, radio stations, television stations (where they should get local and network rates, if possible), bargain sheets, etc. to learn about the cost of advertising in just your local area.

O Have each team report to the entire class on their above findings. Then have the entire class discuss the expense of advertising throughout the region and the nation.

O Have students contact the local county extension agent and learn the location of commercial storage facilities for the region and your general area. The students should then calculate mileage to the various points. Explain to students that their actual cost per mile will depend on their mode of transportation, but that for today you're going to set an imaginary figure (25 cents per mile, for example). Have the students then calculate the difference in cost for transporting items to the various locations, round trip.

OBJECTIVE 3

Discuss factors that influence the share which producers receive on commodities.

- O Divide students into teams. Have each team call or visit a local grocery store and get the price of two food items related to the same commodity, one of which should be fresh and the other somehow processed (examples: fresh green beans and canned green beans, apples and apple juice, pumpkins and pumpkin pies). Each team should brainstorm about the various expenses and agribusinesses likely to have been involved in helping each of these products reach its finished state. Each team should then decide which product is likely to represent the largest farmer's share (hint: it should always be the fresh commodity).
- O Have each team present information about their products and their conclusion about which is likely to represent the largest farmer's share.

OBJECTIVE 4

Discuss factors which determine whether to sell by the pound or by the bushel.

- R Discuss the factors which determine whether to sell by the pound or by the bushel.
- O Have the students write a one to two paragraph report on when it would be most advantageous for farmers to sell by the pound and when they would probably find it most profitable to sell by the bushel.

OBJECTIVE 5

Discuss factors which influence time to market.

- O Write "Weather Outlook," "Supply and Demand," "Storage Costs," and "Price Peaks" on your chalkboard. Then have your students brainstorm about situations that would fall in each of those categories which would 1) make it appear wise to sell immediately and 2) seem to indicate it would be best if farmers waited to market their crops.

OBJECTIVE 6

Discuss the advantages and disadvantages of home storage and commercial storage.

- O Have your students read *Grain Storage Costs in Oklahoma*, OSU Extension Facts, No. 210.
- O Have the students write a short (one to two paragraph) report on what they consider to be the most important pros and cons for both on-farm storage and commercial storage.

OBJECTIVE 7

Explain the types of elevators.

- Take your students on a field trip to a local country point elevator.
- Have the students divide into teams and research the advantages and disadvantages for the average farmer in using either type of elevator. The students should also learn about any restrictions (such as quality of product, size of crop, etc.) imposed by each type elevator.
- Have each team report its findings to the entire class.

OBJECTIVE 8

List factors which determine the federal grades of grain.

- Have your students either bring an actual sample or a picture of damaged kernels to the class.
- Have the students report to the class on the type of damage their pictured or sample kernels have undergone, how it likely occurred, etc.

OBJECTIVE 9

Compare marketing channels.

- Discuss the various marketing channels that are available to farmers.
- Divide the class into five teams. Assign a different marketing channel to each team. Then have all the teams make some type of oral presentation to the class on their assigned channel. The teams should be encouraged to be as creative as possible. For example, they might video tape a farmer's market (if any of the team members have access to a video camera), develop charts and graphs, invite a restauranteur to discuss how they obtain their produce, etc.

OBJECTIVE 10

Explain the principles of using forward marketing, the futures market, and hedging.

- Invite a local commodities broker or county extension agent to visit and explain to the class about the futures market, forward marketing, and hedging.
- Have the students read *Wheat Futures Contract Risk and Returns*, OSU Extension Facts, No. 518.

- Have each student write a short report on either forward marketing, the futures market, or hedging.

OBJECTIVE 11

List sources of crop marketing information.

- Have the class brainstorm on the type of information they would find useful as farmers. Would they want to be connected to a computer network? Or would they prefer to read weekly, monthly, or semi-annual reports?
- Have students contact an association, state agency, or private news service to obtain a copy of some type of market news. They should bring those copies to class. Be sure to make all copies available to the entire class.
- Have your students briefly report to the class on: 1) how they obtained their market news, 2) what type of background or education someone would need to interpret the data it contains, and 3) whether they would find this information helpful if they were a farmer.

OBJECTIVE 12

List methods of marketing crops.

- Discuss the difference between direct and nondirect outlets.
- Visit a direct outlet; it can be either a pick-your-own operation, a roadside stand, or a farmer's market.
- Invite a representative from a local coop or bargaining association to visit and tell the class about the services their organizations offer their members.

OBJECTIVE 13

Discuss markets for specialty crops.

- Have the students research U.S. agricultural imports and see if they can identify one crop that: 1) is likely to grow in Oklahoma, 2) seems to have either an existing market or one that could be easily created, and 3) wouldn't have to compete with a similar product.
- Have your students report on their findings to the class.
- Have the students read *Alternative Crop Development in Oklahoma*, OSU Current Report 2102, and *Taking Advantage of Alternative Agricultural Opportunities*, OSU Extension Facts, No. 869.

OBJECTIVE 14

Discuss sources of funding for nontraditional enterprises.

O Invite your local county extension agent to visit the class and talk about alternative farming enterprises that have been successful in obtaining funding.

O Have students obtain and complete, as a class exercise, applications for a loan for an alternative agricultural enterprise.

O Have students debate the wisdom of starting with a large operation vs. starting small and building.

OBJECTIVE 15

Calculate break-even prices. (Assignment Sheet 1)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 16

Interpret market information. (Assignment Sheet 2)

R See the general instructions for all Assignment Sheets.

OBJECTIVE 17

Identify sources of information and support organizations for specialty enterprises. (Assignment Sheet 3)

R See the general instructions for all Assignment Sheets.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.
- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.

- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.

- Describe the rating scale used on the skills test.

- Reteach and retest as necessary.

- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.

- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.

- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.

- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.

- Complete the appropriate sections of the Competency Profiles.

- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Marketing Challenge in Oklahoma's Produce Industry: Grower Perspective*, OSU Extension Facts No. 513. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

OPTIONAL RESOURCES

Publications

- *Alternative Crop Development in Oklahoma*, OSU Extension Facts No. 2102. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Grain Storage Costs in Oklahoma*, OSU Extension Facts No. 210. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach*. Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.
- *Taking Advantage of Alternative Agriculture Opportunities*, OSU Extension Facts No. 869. Stillwater, OK: Oklahoma State University Cooperative Extension Service.
- *Wheat Futures Contract Risk and Returns*, OSU Extension Facts No. 518. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

UNIT REFERENCES

Publications

- *Alternative Crop Development in Oklahoma*. Stillwater, OK: Oklahoma State University Cooperative Extension Service, Current Report 2102.
- *Cost of Handling Grain in Oklahoma Elevators*. Stillwater, OK: Oklahoma State University Extension Facts, No. 537.

- *Fresh Produce Marketing Alternatives for Oklahoma Fruit and Vegetable Growers*. Stillwater, OK: Oklahoma State University Extension Facts, No 473.
- *Grain Storage Costs in Oklahoma*. Stillwater, OK: Oklahoma State University Extension Facts, No. 210.
- Purcell, Wayne. *Agricultural Marketing: Systems, Coordination, Cash and Futures Prices*. Reston, VA: Reston Publishing Company, Inc., 1979.
- Rhodes, V. James. *The Agricultural Marketing System*, 4th Edition. Scottsdale, Arizona: Gorsuch Scarisbrick, Publishers, 1993.
- *Sorghum Sampling and Hand Sieving Procedures*. Stillwater, OK: Oklahoma State University Cooperative Extension Service, Current Report 162.
- *Soybean Kernel Damage*. Stillwater, OK: Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources, Oklahoma State University.
- *Stored Grain Management in Oklahoma*. Stillwater, OK: Cooperative Extension Service, Division of Agriculture, Oklahoma State University, and Oklahoma Wheat Commission, Circular E-839.
- *Taking Advantage of Alternative Agricultural Opportunities*. Stillwater, OK: Oklahoma State University Extension Facts, N. 869.
- *Wheat Kernel Damage*. Stillwater, OK: Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources, Oklahoma State University.
- *Wheat Sampling and Hand Sieving Procedures*. Stillwater, OK: Oklahoma State University Cooperative Extension Service, Current Report 161.

ASSIGNMENT SHEETS

OBJECTIVE 15

Assignment Sheet 1

1. $5.15
2. $4.55
3. $4.27
4. $4.11

OBJECTIVE 16

Assignment Sheet 2

Answers will vary

OBJECTIVE 17

Assignment Sheet 3

1. Cooperative Extension Office (students might refer to it as County Extension Office or County Extension Officer or Agent)

2. Answers will vary

WRITTEN TEST

OBJECTIVE 1

1. supply, quality of crops, and time of harvest

2. Answer must include five of the following:

   - demand for a commodity
   - how commodities are used (whether they need to be processed and, if so, in what manner)
   - the use of pesticides and other chemicals
   - type of packaging
   - labelling requirements
   - government safety regulations

3. Answer must include two of the following:
   - types of markets that will accept the produce
   - usable yield
   - level of price crops can command
4. the political climate

OBJECTIVE 2

1. advertising
2. transportation
3. storage
4. Processing

OBJECTIVE 3

1. those that change the least in going from the farm to the retail store
2. how much profit agribusinesses make on the sale
   the expenses which those same businesses have to incur
3. Answer must include any five of the following
   - labor in getting the product to the consumer
   - processing/packaging the product
   - advertising the product
   - storing the product
   - transporting the product
   - depreciation costs
   - interest on the investment
   - insurance
   - taxes
   - shrinkage
   - quality deterioration
   - quality maintenance (aeration and pesticides)

OBJECTIVE 4

1. the type of crop
   the moisture content of the commodity

2. amount of rain around time of harvest and when crops are loaded in storage or transportation facilities
   time of harvest (whether it was early or late in the season)
   type and condition of storage and transportation facilities

OBJECTIVE 5

1. weather outlook
   supply and demand
   storage costs
   personal financial condition
   price peaks

2. plan to market then

3. wait to market

4. when supply is low and demand is high

OBJECTIVE 6

1. Answer must include the following:

   - If a commodity is stored for a long time, on-farm storage can be less expensive than commercial.

   - Government grain reserve programs often protect farmers against price falls, which helps to cover certain home storage costs.

   - On-farm storage allows the farmer to shop for alternative outlets offering the best price.

2. Answer must include the following:

   - Home storage comes with risks to the farmer.

3. Answer must include any three of the following:

   - Marketing functions are taken care of by the commercial storage facility.

   - Commercial storage facilities provide services, such as order processing and shipping, that may be important to a farmer.

- Commercial storage facilities often act as the actual distribution center for certain commodities.

- Public warehouses issue negotiable warehouse receipts to the owners of commodities that they are storing. These receipts can be used to secure loans or to settle a futures contract.

4. Answer must include any one of the following:

    - Commercial storage usually limits the farmer to accepting whatever price is offered at that facility.

    - If a commodity is stored for a long time, commercial storage can be more expensive than on-farm storage.

OBJECTIVE 7

1. terminal
   country points

2. Answer must include any three characteristics of both country and terminal point elevators.

    - country points

        - ☐ are usually cooperatives
        - ☐ are scattered throughout the state
        - ☐ are used by local farmers with small to average size crops
        - ☐ market to terminals and/or wholesalers

    - terminals are

        - ☐ located regionally
        - ☐ receive commodities from:
            - ▸ farmers with extremely large crops
            - ▸ country points
        - ☐ market to wholesalers, processors, brokers, and buyers

OBJECTIVE 8

1. Answer should include any five of the following:

   - test weight per bushel
   - class and subclass
   - the presence of foreign material
   - shrunken and broken kernels
   - defects
   - the presence of other classes of the same type of grain
   - the presence of other types of grain

2. Answer should include any ten of the following:

   - heat
   - mold
   - fungus
   - dirt on the exposed part of broken kernels
   - disease
   - being green (immature)
   - germination (show sprout from the germ end)
   - insect infestation
   - frost blistering, candied appearance, flaking, or black or brown discoloration
   - cracks
   - breaks
   - chews
   - garlic bulblets
   - smut
   - improper treatment

OBJECTIVE 9

1. They all start with a producer (farmer) and end with the consumer or consumers.

2. It allows them to sell their entire harvest at little or no additional cost.

3. The farmer must have the skills and knowledge necessary to find and negotiate with a processor.

4. The volume needed depends on the size of the retail outlet and the highest quality commodities are needed.

5. one that doesn't need processing

OBJECTIVE 10

1. to help protect against a fall in price
2. those with growing crops and those who've just harvested their crops but want to wait to sell their products
3. Answer should include all of the following:
    - the amount of commodity being sold
    - at what time and place it should be delivered in the future
    - the price and other terms of the trade
4. actual physical delivery of a product

OBJECTIVE 11

Answer must include the following:

- The National Agricultural Statistical Service (NASS)
- The USDA
- Private groups or trade associations for producers of a specific commodity
- Various wire services
- Federal-state Market News Reports
- Private news services

OBJECTIVE 12

1. Answer must include all of the following:
    - pick-your-own operations
    - roadside stands
    - farmer's markets
2. Answer must include all of the following:
    - terminal markets
    - selling directly to restaurants and grocery stores
    - dealing directly with processors, wholesalers, and brokers

3. Answer must include all of the following:

   - generic promotion of a particular commodity
   - marketing cooperatives
   - bargaining associations

4. Answer must include the following:

   - centralized cooperatives
   - federated cooperatives

OBJECTIVE 13

1. absorb surpluses

2. those that either fill a new market or which provide for a market that is currently served through imports

3. Answer must include three of the following:

   - nutrition and health food
   - soap and cosmetics
   - manufacturers
   - gourmet food outlets and restaurants
   - plant stores and nurseries
   - seasonal markets

OBJECTIVE 14

1. financially distressed farmers and people who are entering into alternative agricultural enterprises

2. Farmers Home Administration

3. significant applicable education and/or farm or ranch experience to stand a reasonable chance of success in the proposed plan of operation

OBJECTIVE 15 **Evaluated on Assignment Sheet 1.**

OBJECTIVE 16 **Evaluated on Assignment Sheet 2.**

OBJECTIVE 17 **Evaluated on Assignment Sheet 3.**

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) *Soil, Plant, and Crop Science*

UNIT NUMBER AND TITLE **– E-1 Marketing Crops and Grades**

TOTAL NUMBER OF TEST QUESTIONS **51**

TOTAL NUMBER OF BASIC SKILL QUESTIONS **16**

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-4	X
2	1-4	X
3	1-3	X
4	1-3	X
5	1-4	W
6	1-4	X
7	1-2	X
8	1-2	X
9	1-5	W
10	1-4	W
11	1-6	X
12	1-4	X
13	1-3	W
14	1-3	X
15	Evaluated on AS 1	
16	Evaluated on AS 2	
17	Evaluated on AS 3	

INSTRUCTOR'S GUIDE

PRICE TRENDS AND CYCLES

E-2

Required Activities and Resources (R)

These are fully integrated components of this CIMC curriculum. They are usually packaged in or with the curriculum and are essential in meeting the learning objectives. To individualize this unit, use the LAP Sheet supplied in your resources.

- Reproducible Handouts and Transparency Masters are included in the Instructor's Resource Package. Handouts should be copied for all students. Transparency Masters should be used to make overhead transparencies for use during instruction. A small copy of each Transparency Master appears in the student's Information Sheets.
- Non-reproducible resources are included in the student's curriculum.

Optional Activities and Resources (O)

These are suggested high-interest activities to help deliver learning objectives to students or to let students achieve objectives in an applied context. Select as many as you wish to use. Some activities use extra resources for further information about unit content. You can make them available in the classroom for in-depth study or optional activities, but their use is not required for meeting CIMC unit objectives.

FOCUS ASSIGNMENTS

Prereading

R Read *Changing Market Institutions and Trends in Food Consumption*, OSU Extension Bulletin No. 789.

Writing

R Have the students write a short essay (one paragraph to one page) on one trend in food consumption.

GENERAL INSTRUCTIONS

Assignment Sheets

- **R** Review the directions and any specific guidelines.
- **R** Make certain that any needed materials from the Instructor's Resource Package are available.
- **R** Have the students complete the Assignment Sheet. Evaluate each student's performance and provide reteaching and retesting as necessary. Have the students repeat the Assignment Sheet until they achieve mastery.
- **R** Complete each student's Competency Profile.
- **O** Have the students volunteer to read aloud the directions and any special guidelines.
- **O** Return the completed Assignment Sheets to the students so that they may use them for later reference if needed.

Job Sheets

- **R** Review the introduction and evaluation criteria for the Job Sheet. Remind the students that they should not fill in the blanks in the Yes/No columns.
- **R** Review and explain all general guidelines, safety cautions, and warnings.
- **R** Make sure that all tools, equipment, and supplies are available.
- **R** Demonstrate each of the procedures outlined in the Job Sheet.
- **R** Allow the students to practice the Job Sheet skills before skills testing. Coach, correct, and supervise as necessary.
- **R** Have the students complete the Job Sheet. Evaluate each student's performance and provide remediation as necessary. Have the students repeat the Job Sheet until they achieve mastery.
- **R** Complete each student's Competency Profile.
- **R** Return the completed Job Sheets to the students so that they may use them for later reference if needed.
- **O** Have the students volunteer to read aloud the job guidelines, cautions, and warnings.

LAP Sheets

The LAP Sheets are an optional component that can be used to individualize instruction. The following instructions should be followed only if you are using the LAP Sheets.

R Explain the specific procedures to be followed to the students before they begin using the LAP Sheet. Be sure that each student understands the procedures for using the LAP Sheet.

R If you want the student to complete any of the assignments on the LAP Sheet that are labeled optional, assign these to the student. Be sure to provide any needed resources.

OBJECTIVE 1

Discuss trends and cycles in the marketing of crops.

O Have students obtain and read a copy of *Oklahoma Agricultural Trends*, OSU Extension Bulletin No. 805, from their local county extension office.

O Have students write a report on one of the trends covered in the bulletin.

OBJECTIVE 2

Discuss supply and demand.

O Create different supply and demand scenarios and have students draw the supply and demand curves for each.

EXAMPLE: A shift in the supply curve of cotton.

O Have students write a brief report on how a government program has affected the supply of any commodity in the past ten years.

O Have students brainstorm in class about how technology is likely to affect the supplies of future crops (discuss specific commodities).

OBJECTIVE 3

List factors that can affect the supply of a commodity.

OBJECTIVE 4

Describe factors that cause shifts in the demand for a commodity.

O Have students debate about whether changes in the public's acceptance of smoking is likely to affect the demand for tobacco in the future. And if so, how that is likely to affect the tobacco farming industry.

- Have students interview adults in their extended family (parents, grandparents, aunts, uncles, etc.) about any changes the adults have ever made in their patterns of buying farm commodities due to a change in their disposable income.

  EXAMPLES: Perhaps after getting a raise or a new job they started buying more expensive vegetables, like asparagus, more often, or using real butter instead of margarine.

  OR

  If they lived through the depression they may have not been able to afford certain fruits, etc.

- Make a giant two column list on the classroom chalkboard with one column headed "positively affected" and the other headed "negatively affected." Then, have students indicate under positively affected any items their relatives started using when they had more disposable income. On the other side they should list all items that their relatives either stopped consuming or consumed in smaller quantities when money was tight. Note how many times different commodities are listed and if the same items appear in both columns.

OBJECTIVE 5

Describe the effect that world production and consumption has on a commodity.

- Divide students into teams, then have each team develop a classroom game that would demonstrate how world production and consumption affects a commodity.

  ☑ **NOTE:** The games should NOT be very involved or complex. To get your students started, you might suggest that they all begin their games by dividing the class into five "countries" that can either purchase and/or produce 10 specific U.S. commodities, then let the students develop the rest of their games from that point.

- Have each team explain the game it developed to the entire class.

- Have the class vote on which game it would like to play, then play it.

OBJECTIVE 6

Rank countries according to their production of various commodities.

O Discuss how in the 1980s American agriculture accounted for 10 percent of world agricultural output, but 15 percent of world agricultural trade, and what this might indicate about our import/export situation.

O Have the students write a short report comparing the agricultural production of a country (one not covered in their Objective 5 Information Sheets) with that of the U.S.

O Have the students give a brief (2-3 minute) oral presentation on their report.

OBJECTIVE 7

Discuss factors affecting prices for farm commodities.

O Discuss scenarios involving shifts in supply and demand levels and have students indicate whether those shifts would make prices rise or fall.

O Have the students write a short report on how production levels affect prices.

OBJECTIVE 8

Discuss pricing effectiveness.

O Discuss the effectiveness of the various pricing methods.

O Have students debate the pros and cons of using the various methods of price discovery.

OBJECTIVE 9

Identify current market trends for one product. (Assignment Sheet 1)

R See the general instructions for all Assignment Sheets.

O Obtain market data for students. Help students select different items for variety in class. Discuss with students how to chart and interpret data.

OBJECTIVE 10

Present an oral report on market trends. (Assignment Sheet 2)

R See the general instructions for all Assignment Sheets.

R Review with students how to give a speech. Give students the time requirement for the speech.

OBJECTIVE 11

Plot demand and supply curves. (Assignment Sheet 3)

R See the general instructions for all Assignment Sheets.

R Review with students how to plot demand and supply curves.

EVALUATION

Pretest

- Use the unit Written Test for *both* the pretest and posttest. Give the students the pretest before they begin the unit.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving pretests and using the results. Information for ordering this material is included in the optional resources section.
- Use pretest results to guide individual students in progressing through the unit, doing enrichment work, or moving to the next unit.

Focus Assignment

- Use an informal evaluation of the focus assignments as a diagnostic tool for determining if any students need extra help in reading comprehension or writing skills. Refer these students to their English instructor, Learning Resource Center, or Educational Enhancement Center.

Assignment Sheet

- Evaluate students on Assignment Sheet activities. Students must repeat an Assignment Sheet until they have mastered the activity.
- Complete each student's Competency Profile.

Skill Test

- Explain to the students that they will be asked to demonstrate the procedures on the Job Sheets as a skills test.
- Describe the rating scale used on the skills test.
- Reteach and retest as necessary.
- Complete each student's Competency Profile.

Posttest

- After they have completed the unit, give students the Written Test again.
- Explain to the students that they will be asked to demonstrate on the Written Test actions listed in the specific objectives.
- You may wish to use the CIMC publication *Measuring Learning and Competency Gains: The Pretest/Posttest Approach* for instructions and suggestions on giving posttests and using the results. Information for ordering this material is included in the optional resources section.
- Reteach and retest as necessary to meet individual student needs and state standards for student learning and competency gains.
- Complete the appropriate sections of the Competency Profiles.
- Review individual and group performance to evaluate teaching effectiveness. Adjust scope, sequence, or instructional methods for additional lessons as required.

REQUIRED RESOURCES

The items marked with an asterisk are included in the Instructor's Resource Package.

Publications

- *Changing Market Institutions and Trends in Food Consumption.* OSU Extension Bulletin No. 789. Stillwater, OK: Oklahoma State University Cooperative Extension Service.

OPTIONAL RESOURCES

Publications

- *Measuring Learning and Competency Gains: The Pretest/Posttest Approach.* Stillwater, OK: CIMC, Oklahoma Department of Vocational and Technical Education, 1992. For ordering information call 800-522-5810.

UNIT REFERENCES

Publications

- *An Introduction to Commodity Marketing,* Teacher Guide, 1990/1991. Chicago, Illinois: Chicago Mercantile Exchange, 1991.

- *Animal Science, Instructors Resource Package.* Stillwater, Oklahoma: Oklahoma Department of Vocational and Technical Education, 1995.
- *Animal Science, Student Workbook.* Stillwater, Oklahoma: Oklahoma Department of Vocational and Technical Education, 1995.
- *Marketing Agricultural Products: Curriculum Guide for Secondary/Post Secondary Agriculture Programs.* Ames, Iowa: Department of Agricultural Education, Iowa State University, 1988.
- Purcell, Wayne D. *Agricultural Marketing: Systems, Coordination, Cash, and Futures.* Reston, Virginia: Reston Publishing Company, Inc. (a Prentice Hall Company), 1979.
- Tweeten, Luther. *Agricultural Trade: Principles and Policies.* Boulder, Colorado: Westview Press, 1992
- *World Agriculture Trends and Indicators, 1970-91.* Washington, D.C.: United States Department of Agriculture, Statistical Bulletin Number 861, 1994.

ASSIGNMENT SHEETS

OBJECTIVE 8

Assignment Sheet 1

Students' answers will vary. Students should compile a chart showing the information they've gathered, and write their response to each question.

OBJECTIVE 9

Assignment Sheet 2

Make sure the student's presentation is:

- well-organized
- well-rehearsed
- complete
- proper length

OBJECTIVE 10

Assignment Sheet 3

Students' charts should show:

1. price will fall

2. price will rise

3. price will rise

4. price will fall

WRITTEN TEST

OBJECTIVE 1

1. The movement of crop prices over a period of time.
2. At least two times when decisions are made about production, or two crop years.
3. It deals with price movements over a period of time.
4. A cycle involves a series of market movements that happen regularly over a long period of time. Trends are general market movements that occur in no particular order.
5. They can help the farmer decide how much to produce and when to sell crops.

OBJECTIVE 2

1. The amount of a commodity that farmers are willing to sell at a given price.
2. The amount of a commodity that buyers are willing to purchase on the open market at a given price.
3. Price changes do not significantly affect the amounts consumers purchase.
4. The law of demand is the relationship between demand and the price for products with an elastic demand. When prices are up, buyers normally buy less of these products. When prices are low, consumers usually buy more.
5. The law of supply is the relationship between supply and price. When prices are high farmer's are willing to release a higher quantity than when prices are low.

OBJECTIVE 3

Answer should include six of the following:

- Weather
- Crop yields
- How much is in storage
- Imports and exports
- Technology

- Government programs
- Cost of production
- Market price

OBJECTIVE 4

1. Answer should include all of the following:
    - consumer tastes
    - disposable income
    - population size
    - cost of substitute goods
2. Consumers will treat themselves to luxuries when they have extra money. Households with little extra cash will either buy less of those things they don't absolutely need, or simply stop buying them at all.
3. The larger the population, the more consumers there are for products. When the population declines, so does demand for a product.
4. Demand for a specific product may decrease if consumers can purchase substitute goods at a lower price.

OBJECTIVE 5

1. Demand for the product increases, raising prices and the need for supply
2. Farming production would have to be scaled back about .5 percent per year, because U.S. supply exceeds domestic demand.
3. Products like coffee, cocoa, and bananas that don't compete with the temperate zone farm products that we export
4. The supply of the product increases. This lowers the demand for and price of U.S. products.

OBJECTIVE 6

1. 5 Bangladesh
   - 4 Canada
   - 1 China
   - 3 former Soviet Union
   - 2 United States

2. 3 Canada
   - 2 China
   - 5 Japan
   - 4 former Soviet Union
   - 1 United States

3. 5 Australia
   - 2 China
   - 3 Japan
   - 1 United States
   - 4 former West Germany

4. 1 China
   - 4 Japan
   - 3 former Soviet Union
   - 2 United States
   - 5 former West Germany

OBJECTIVE 7

1. The market price may also change.

2. Answer should include any two of the following examples:

WHEN SUPPLY IS	AND DEMAND IS	THEN THE PRICE WILL
Up	The same	Fall
Down	The same	Rise
The same	Up	Rise
The same	Down	Fall

OBJECTIVE 8

1. Helping decide what to pay or charge for a commodity that is either currently on the market, or which will be on the market in the immediate future

2. To make long-term price projections or decisions

3. Instead of relying on what is known, it projects into the future

4. Answer should include all three of the following:
   - formula pricing
   - committee pricing
   - administered pricing

5. Prices on the open market are vulnerable to daily supply and demand fluctuations, and they can be affected by rumor and the tendency to overreact to any perceived change in supply and demand.

OBJECTIVE 9 **Evaluated on Assignment Sheet 1.**

OBJECTIVE 10 **Evaluated on Assignment Sheet 2.**

OBJECTIVE 11 **Evaluated on Assignment Sheet 3.**

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) ***Soil, Plant, and Crop Science***

UNIT NUMBER AND TITLE – E-2 Price Trends and Cycles

TOTAL NUMBER OF TEST QUESTIONS **36**

TOTAL NUMBER OF BASIC SKILL QUESTIONS **26**

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	**1-5**	**W,U**
2	**1-6**	**W,U**
3	**1-6**	**X**
4	**1-4**	**W,U**
5	**1-4**	**W,U**
6	**1-4**	**X**
7	**1-2**	**U**
8	**1-5**	**W,U**
9	**Evaluated on AS 1**	
10	**Evaluated on AS 2**	
11	**Evaluated on AS 3**	

Soil, Plant, and Crop Science

Instructor's Resource Package

LAP Sheets

Transparency Masters

Written Tests

Handouts

Developed by the
Curriculum and Instructional Materials Center
for the Division of Agricultural Education
Oklahoma Department of Vocational and Technical Education

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LAP
SHEET

INTRODUCTION TO SOIL, PLANT, AND CROP SCIENCE

A-1

Name ______________________________

Check the blank as you complete each step.

1. **Take**	____	the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.
2. **Read**	____	the introduction, unit objective, and specific objectives.
3. **Do**	____	the focus assignments.
4. **Stop**	____	and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.
5. **Study**	____	the Information Sheet, objective 1.
Optional: Write	____	a short paper on the importance of soil to a particular civilization or era. Possible topics might include the Egyptians or the "Dust Bowl" of the 1930s.
Optional: Examine	____	different types of soil samples from your area.
6. **Study**	____	the Information Sheet, objective 2.
Optional: Write	____	a short paper stating your opinion on why it is necessary for people to be concerned about soil preservation and management.

May be photocopied for student use.

7. **Study**	____	the Information Sheet, objectives 3 and 4.
Optional: Examine	____	potted plants and observe how the plants use the soil.
8. **Study**	____	the Information Sheet, objective 5.
Optional: Write	____	a short paper on how agriculture has changed in the United States.
Optional: Research	____	agriculture in third world countries.
9. **Study**	____	the Information Sheet, objective 6.
Optional: Research	____	an environmental issue, such as sewage sludge, and give a brief oral report (2-3 minutes) to the class.
Optional: Research	____	current magazines and newspapers for articles that deal with environmental issues that affect plant agriculture.
Optional: Read	____	OSU Extension Facts No. 2242, *Nitrates in Soil and Water.*
10. **Study**	____	the Information Sheet, objective 7.
Optional: Interview	____	a livestock rancher on the relationship between livestock and crop production.
Optional: Read	____	OSU Extension Facts No. F-2586, *Wheat for Pasture.*
11. **Study**	____	the Information Sheet, objective 8.
Optional: Examine	____	products that are made using plants.

May be photocopied for student use.

Optional: Read _____ OSU Current Report CR-2102, *Alternative Crop Development in Oklahoma* and/or selections from *New Crops, New Uses, New Markets* and *New Crops for Food and Industry.*

Optional: Research _____ current magazines and newspapers for articles relating to non-agricultural uses of plants.

12. Study _____ the Information Sheet, objective 9.

Optional: Practice _____ using the binomial system by finding examples of the genus and species of plants.

13. Do _____ the Assignment Sheet.

14. Stop _____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

15. Take _____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

May be photocopied for student use.

WRITTEN TEST

INTRODUCTION TO SOIL, PLANT, AND CROP SCIENCE

A-1

Name ______________________ Date ________ Score ___

OBJECTIVE 1

Define soil. Define the term soil in the blanks provided.

____

____

____

OBJECTIVE 2

State reasons why soil is important. State the four reasons soil is important in the blanks provided.

1. ____
   ____
2. ____
   ____
3. ____
   ____
4. ____
   ____

May be photocopied for student use.

OBJECTIVE 3

List the factors responsible for soil formation. List the six factors responsible for soil formation in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

OBJECTIVE 4

Describe how plants use soil. Describe how plants use soil for four primary needs.

1. ______________________________
____
2. ______________________________
____
3. ______________________________
____
4. ______________________________
____

May be photocopied for student use.

OBJECTIVE 5 **Discuss how trends affect agricultural production.** Write a short answer to the following questions in the blanks provided.

1. What trend has created pressure on agriculture to be more productive?

___

___

___

2. As the standard of living rises, what do people demand from agriculture?

___

___

___

3. What has caused farm productivity to increase and farming to become more complex?

___

4. Opportunities for bringing land into production by irrigation are offset by what?

___

___

May be photocopied for student use.

OBJECTIVE 6

Identify environmental issues affecting plant agriculture. Place an "X" in front of correct answers.

____ 1. Soil erosion

____ 2. Changing diets of people

____ 3. Pollution by fertilizer nutrients

____ 4. Increasing salinity of soil and water

____ 5. Decreasing number of people in research

____ 6. Pollution by pesticides

____ 7. Pollution by non-domestic animals

____ 8. Solid wastes

____ 9. Pollution by petrochemicals

____ 10. Wastewater

____ 11. Decreasing world population

____ 12. Diminishing water supplies

____ 13. Diversion of land to non-agricultural uses

____ 14. Increasing water supplies

OBJECTIVE 7

Describe the relationship between livestock and crop production. Describe the relationship in the blanks provided.

May be photocopied for student use.

OBJECTIVE 8

Describe non-agricultural uses of plants. Answer the following questions in the blanks provided.

1. Describe three uses of plants in the chemical industry.

2. Describe one use of plants in the pharmaceutical/medicinal industry.

3. Describe one use of plants in the transportation industry.

May be photocopied for student use.

OBJECTIVE 9

Use the binomial system of plant classification. Answer the questions in the blanks provided.

1. What is the genus of *Triticum vulgare.*

   ____

2. What is the genus of *Trifolium repens.*

   ____

3. What is the species of *Triticum durum.*

   ____

4. Write the scientific name for the peach tree which has "prunus" as its genus and "persica" as its species.

   ____

OBJECTIVE 10

Evaluated on the Assignment Sheet.

May be photocopied for student use.

This Is Not Dinner

When most people think of agriculture they think of foods they might find on their dinner plate such as breads, salads, or meat. But agriculture provides products for much more than food. The chemical industry, pharmaceutical industry, and transportation industry all benefit from agricultural products. Many uses of agricultural products are still in research and their potential benefits are not yet known. Plant products are already used in many medicines and research is focusing on the possible chemotherapeutic agents and cancer prevention agents that might be in agricultural products. Plants used for non-agricultural products may also provide farmers with new sources of income. Some potential new crops for farmers are discussed below.

Kenaf is a fiber crop that has long been grown in parts of Africa and Asia for products such as burlap, rope, and twine. The principal purpose of kenaf as a crop is to produce stalks that can be ground and used in the manufacture of pulp and paper products such as newsprint or tissue. Kenaf has slowly become a commercial crop in the United States in areas of South Texas and southern Louisiana.

Guayule is a shrub that has natural rubber and grows in the United States. Currently, all the rubber produced comes from the hevea tree, grown primarily in Southeast Asia. The guayule shrub grows in environments such as the Southwestern United States. Currently, because of unavailable facilities for processing and the reluctance of industry to commit to an alternative crop, guayule is only a prospect for the future.

Rapeseed and crambe have recently emerged as commercially viable alternative oil crops. The erucic acid oils and their derivatives have very good lubricating properties and can be used in the manufacturing of nylons, paints, and coatings.

Milkweed is being researched as a potential fiber crop and jojoba oil is used extensively in the cosmetics industry. There are many other non-agricultural uses of plants that are being researched and others that have yet to be discovered.

The application of biotechnology to the development of new plants will impact the area of non-agricultural uses of plants. The possibilities of non-agricultural uses of plants are virtually endless. A major obstacle in developing new uses of plants is cost: farmers must be able to make a profit. But with the pharmaceutical and industrial applications, new uses of plants will certainly continue to be researched.

May be photocopied for student use.

LAP SHEET

SAFETY

A-2

Name ________________________________

Check the blank as you complete each step.

1. Take	____	the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.
2. Read	____	the introduction, unit objective, and specific objectives.
3. Do	____	the focus assignments.
4. Stop	____	and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.
5. Study	____	the Information Sheet, objective 1.
Optional: Obtain	____	copies of MSDSs that list chemicals used in agriculture. Go over the information in the different sections.
Optional: Overview	____	29 CFR 1910.1200 *Hazard Communication Standard.*
Optional: Compile	____	a list of resources and phone numbers for assistance in gathering information regarding hazardous wastes.
Optional: Overview	____	the *Oklahoma Hazard Communication Standard.*
Optional: Read	____	current OSHA publications and fact sheets.

May be photocopied for student use.

6. Study ____ the Information Sheet, objectives 2-4.

Optional: Read ____ OSU Extension Facts No. 7457, *Toxicity of Pesticides* and No. 7453 *First Aid for Pesticide Poisoning.*

Optional: Refer ____ to the section on Pesticide Safety in the OSU publication E-834, *Applying Pesticides Correctly.*

Optional: Interview ____ a medical professional about the symptoms of pesticide poisoning.

7. Study ____ the Information Sheet, objective 5.

Optional: Refer ____ to the section on Pesticide Safety in the OSU publication E-834, *Applying Pesticides Correctly.*

Optional: Read ____ OSU Extension Facts No. F-1012, *Pesticide and Fertilizer Facility Operations* and No. F-1723, *Anhydrous Ammonia Safety.*

Optional: Read ____ information on agricultural safety from Oklahoma State University Project Safe or from the National Institute for Occupational Safety and Health.

8. Study ____ the Information Sheet, objective 6.

Optional: Refer ____ to the section on Pesticide Safety in the OSU publication E-834, *Applying Pesticides Correctly.*

Optional: Examine ____ examples of protective clothing and equipment.

9. Study ____ the Information Sheet, objective 7.

Optional: Refer ____ to the section on Pesticide Safety in the OSU publication E-834, *Applying Pesticides Correctly.*

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Optional: Read	____	OSU Extension Facts No. 7451, *Agricultural Pesticide Storage.*
10. Study	____	the Information Sheet, objective 8.
Optional: Refer	____	to the section on Pesticide Safety in the OSU Publication E-834, *Applying Pesticides Correctly.*
11. Study	____	the Information Sheet, objective 9.
Optional: Refer	____	to the section on Labels and Labeling in the OSU Publication E-834, *Applying Pesticides Correctly.*
Optional: Examine	____	pesticide labels. Review the information contained on the label.
Optional: Review	____	the different hazard warning systems.
12. Study	____	the Information Sheet, objective 10.
Optional: Read	____	OSU Extension Facts No. F-2242, *Nitrates in Soil and Water*; OSU Publication E-891, *Water Quality and Agriculture's Role for the Future*; OSU Extension Facts No. F-1512, *Groundwater Quality and Treatment*; and/or OSU Extension Facts No. F-7459, *Pesticides in Ground Water.*
Optional: Write	____	a report on the problem of groundwater contamination.
13. Study	____	the Information Sheet, objectives 11-12.
Optional: Interview	____	the shop instructor about hand tool and power tool safety precautions and procedures.
Optional: Examine	____	different hand and power tools. Make a list of hazards that may be associated with each tool. For example, sharp edges or guards.

Optional: Read ____ short scenarios of accidents occurring with equipment and write a short discussion of what could have been done to prevent the accidents.

14. Study ____ the Information Sheet, objective 13.

Optional: Read ____ OSU Extension Facts F-1727, *Machinery Safety on the Farm* or OSU Publication CR-1726, *Grain Bin Entrapment: What If It Happens to You?*

Optional: Interview ____ a farmer or rancher about safety around large equipment. Write a short report over the interview.

15. Do ____ Assignment Sheet 1.

16. Stop ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

17. Do ____ Assignment Sheet 2.

18. Stop ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

19. Take ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

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WRITTEN TEST SAFETY A-2

Name ______________________ Date ________ Score ___

OBJECTIVE 1

Describe the purpose of a Material Safety Data Sheet. Describe the purpose in the blanks provided.

____

____

____

____

____

____

____

____

OBJECTIVE 2

Define acute and chronic toxicity. Write the definitions in the blanks provided.

1. **Acute toxicity** – ______________________

   ____

   ____

2. **Chronic toxicity** – ______________________

   ____

   ____

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OBJECTIVE 3

Define oral, dermal, and inhalation toxicity. Write the definitions in the blanks provided.

1. **Oral toxicity** – ______________________________

____

____

2. **Dermal toxicity** – ______________________________

____

____

3. **Inhalation toxicity** – ______________________________

____

____

OBJECTIVE 4

List symptoms of pesticide poisoning. Write ten symptoms in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________

May be photocopied for student use.

OBJECTIVE 5

Choose the word or phrase to complete statements about chemical safety precautions. Write the corret letters in the blanks provided.

____ 1. If symptoms of poisoning appear during or shortly after handling pesticides:

A. never use those pesticides again
B. immediately seek medical attention
C. immediately review the person's personnel file
D. want ten minutes to see if symptoms disappear

____ 2. When using pesticides, all label directions should be:

A. read aloud by a supervisor
B. in at least two languages
C. read and followed carefully
D. initialed by a supervisor

____ 3. While handling pesticides, do NOT eat, drink, or:

A. smoke
B. talk
C. take breaks
D. both a and b

____ 4. Dispose of empty containers promptly, safely, and:

A. after rinsing them one time
B. with a supervisor's approval
C. according to the law
D. in the first available garbage can

____ 5. Pesticides should not be applied during or just before expected high winds or heavy rain or:

A. away from the prevailing wind direction
B. after rainfall of more than 1/2"
C. within one hour of sunset
D. directly into the wind

____ 6. When using highly toxic pesticides:

A. do NOT work alone
B. take a break every 15 minutes
C. inform someone of your location
D. always work in teams of three or more

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____ 7. Mix pesticides where there is adequate ventilation and in a(n):

A. closed area
B. open area
C. fenced area
D. locked area

____ 8. Keep livestock, pets, and unauthorized individuals out of:

A. areas within 100 yards of pesticide sites
B. pesticide use sites for 10 minutes
C. areas within one mile of pesticide sites
D. areas of mixing, loading, and application

____ 9. If pesticides are splashed or spilled on the skin or clothing, remove the clothing at once and:

A. wash the skin thoroughly with soap and water
B. dispose of the clothing
C. rinse the skin with plain water
D. wash the skin with a damp sponge

____ 10. Always wear the appropriate protective clothing and equipment and:

A. dispose of contaminated clothing
B. properly clean contaminated clothing
C. only clean contaminated clothing by taking to a professional cleaner
D. avoid getting clothing contaminated

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OBJECTIVE 6

Complete statements about the importance of protective clothing and equipment. Write the correct word or words in the blanks.

1. At the minimum wear __________________ shirts and __________________ trousers or a coverall garment.
2. Wear _____________ or a _________ _________ to protect your eyes, when needed.
3. Wear boots that are _________________________ such as neoprene or rubber boots.
4. Wear a wide-brimmed _______________________ hat to protect your head and neck.
5. Properly using protective clothing and equipment will _____________ pesticides from entering your body.
6. Always wear _____________ that are liquid-proof rubber, vinyl, or plastic when handling pesticides.
7. Check the _____________ on fumigants for appropriate protective clothing.

OBJECTIVE 7

Select from a list true statements concerning chemical storage. Place an "X" in front of true statements.

____ 1. Store pesticides in a safe area that is cool, dry, well-ventilated, lighted, out of direct sunlight, and insulated to prevent freezing or overheating.

____ 2. Keep a current inventory of the pesticides.

____ 3. Check pesticide containers for leaks.

____ 4. Pesticides and feed may be stored in the same area if they are clearly labeled.

____ 5. Supply the storage area with appropriate materials for cleaning up spills.

____ 6. Keep the storage area locked to avoid entry by unauthorized persons.

____ 7. Store pesticides in color coded containers.

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_____ 8. Keep an appropriate fire extinguisher available.

_____ 9. Inventory pesticides once per year.

_____ 10. Store pesticides in their original, closed, labeled containers.

_____ 11. Do NOT store pesticides near food, feed, seed, or animals.

_____ 12. If large quantities of pesticides are stored on site, notify the local fire department of the location, amounts, and types of pesticides.

_____ 13. Store pesticides that come packaged in paper containers off of the floor.

_____ 14. Keep the storage area unlocked when it will be used frequently.

_____ 15. Post warning signs on the doors and windows of the storage area.

_____ 16. READ AND FOLLOW label instructions for storage.

_____ 17. Store pesticides in a fireproof area that has a cement floor.

_____ 18. Pesticides may be stored in a storage building near where people or animals live.

_____ 19. Do NOT store pesticides in the sun or near other souces of heat.

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OBJECTIVE 8

Choose correct methods of hazardous waste disposal. Write the correct letter in the blanks provided.

_____ 1. Excess pesticides can be disposed of by:

A. pouring them down the drain
B. wrapping them in newspaper and placing them with regular garbage
C. taking them to a landfill operating under the Environmental Protection Agency or a state permit for pesticide disposal
D. taking them to a landfill operating under the federal landfill commission

_____ 2. Empty containers that have been triple rinsed can be disposed of by:

A. placing them in a sanitary landfill
B. burying them in your backyard
C. reusing them for household storage
D. reusing them for other pesticides

_____ 3. Empty containers that have not been triple rinsed can be disposed of by:

A. reusing them for other pesticides
B. wrapping them in newspaper and placing them with regular garbage
C. taking them to a landfill operating under the federal landfill commission
D. taking them to a landfill operating under the Environmental Protection Agency or a state permit for pesticide disposal

_____ 4. If you cannot dispose of empty containers or excess pesticides right away,:

A. place them so that they are easily seen and not forgotten for later disposal
B. mark the pesticides "for disposal only"
C. keep them in a locked storage area until they can be properly disposed of
D. place the containers in their original storage area

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OBJECTIVE 9

Discuss labeling of hazardous materials. Write your answers in the blanks provided.

1. State two reasons why hazardous materials must be labeled.

____

____

____

____

2. Employer responsibilities for labeling include ensuring that each container of hazardous chemicals in the workplace is labeled, tagged, or marked with what two items?

____

____

____

3. What language must the labels be in?

____

4. What should be done with hard-to-read labels?

____

____

5. What should be followed when labeling hazardous chemicals?

____

____

____

May be photocopied for student use.

OBJECTIVE 10

Choose the word or phrase to complete statements about chemical use and groundwater protection. Write the correct letters in the blanks.

_____ 1. Many people depend on groundwater as a source of drinking water and also as:

A. indications of fertile soil
B. a source for irrigation
C. pond water
D. a source for dumping liquid wastes

_____ 2. To minimize the risk of groundwater contamination follow label directions carefully and:

A. only use chemicals in the winter months
B. use less than the recommended amount of chemical
C. alternate chemical families
D. have well-planned irrigation schedules to follow

_____ 3. Although chemicals are an important component of pest management, other methods of control are often appropriate, such as:

A. integrated pest management programs
B. plowing under the crops
C. underwatering the crops so pests will leave
D. overwatering the crops to drown out pests

_____ 4. Methods of pest control should be chosen for the following reasons EXCEPT:

A. effective
B. environmentally sound
C. evaporation rate
D. economical

_____ 5. Major factors which determine whether chemicals will reach the groundwater include all of the following EXCEPT:

A. the amount and timing of surface water such as rain or irrigation
B. the number of pests which absorb the chemical
C. characteristics and application method of the chemical
D. type of soil

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OBJECTIVE 11

List hand tool safety precautions and procedures. Write eight safety precautions in the blanks provided.

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

6. ____________________

7. ____________________

8. ____________________

May be photocopied for student use.

OBJECTIVE 12

List power tool safety precautions and procedures. List eight safety precautions in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________

May be photocopied for student use.

OBJECTIVE 13

Complete statements concerning safety around large equipment. Write the correct word or words in the blanks.

1. Always follow ______________ instructions and safety practices.
2. ________ ________ the equipment before making any repair or adjustment.
3. Make sure that ________ ________ ________ ________ are fully shielded.
4. ____________ equipment for missing or damaged safety guards and signs.
5. Be aware of potential ____________ involved with the equipment you are operating or working around.
6. Do NOT wear loose, baggy clothing or jewelry that may ____________ on equipment.
7. Pay attention at all times when around or operating ____________.
8. Know how to properly ____________ equipment.

OBJECTIVE 14

Evaluated on Assignment Sheet 1.

OBJECTIVE 15

Evaluated on Assignment Sheet 2.

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LAP SHEET

CAREERS

A-3

Name ______________________________

Check the blank as you complete each step.

1. Take	____	the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.
2. Read	____	the introduction, unit objective, and specific objectives.
3. Do	____	the focus assignments.
4. Stop	____	and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.
5. Study	____	the Information Sheet, objective 1.
Optional: Discuss	____	career selection with a career counselor.
Optional: Complete	____	an interest inventory.
Optional: Watch	____	one or more videos on careers.
Optional: Use	____	a computer data base program to research educational requirements for various careers in crop science.
6. Do	____	Assignment Sheet 1.
Optional: Read	____	*Exploring Careers in Agronomy, Crops, and Soils* and *Challenging Careers in Soil Conservation.*

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7. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

8. **Do** ____ Assignment Sheet 2.

9. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

10. **Study** ____ the Information Sheet, objective 4.

Optional: Discuss ____ careers with individuals employed in crop science.

Optional: Watch ____ one or more videos which focus on areas of study/ specialization in crop science.

11. **Study** ____ the Information Sheet, objective 5.

Optional: Read ____ the Oklahoma State University Cooperative Extension Service series *Skills For Employment.*

Optional: Watch ____ one or more videos which focus on obtaining employment.

12. **Do** ____ Assignment Sheet 3.

13. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

14. **Study** ____ the Information Sheet, objective 7.

Optional: Write ____ a letter to a public or private organization requesting information about job opportunities or general information about the organization.

Optional: Watch ____ one or more videos which focus on different careers.

15. **Do** ____ Assignment Sheet 4.

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16. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

17. **Do** ____ Assignment Sheet 5.

18. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

19. **Do** ____ Assignment Sheet 6.

Optional: Review ____ presentation skills.

20. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

21. **Take** ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

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WRITTEN TEST

CAREERS

A-3

Name ______________________ Date _________ Score ____

OBJECTIVE 1

Discuss employment opportunities at various educational levels. Write your answers in the blanks provided.

1. What four actions can you take to make you a more desirable employee regardless of your educational level?

____

____

____

____

2. What educational level do you need in order to enter the work force at a professional level with a high degree of career advancement possibility?

____

3. What does a two-year associate degree or vocational training enable you to do?

____

____

____

____

4. What educational level do you generally need in order to become a professor, a researcher, or other specialist in crop science?

____

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5. What does a high school education enable you to do in the work force?

____

____

____

OBJECTIVE 2 **Evaluated on Assignment Sheet 1.**

OBJECTIVE 3 **Evaluated on Assignment Sheet 2.**

OBJECTIVE 4 **Determine areas of study/specialization in crop science.** Write the correct letter in the blanks provided.

A. education
B. private sector
C. science
D. marketing
E. agribusiness
F. agriscience
G. international
H. public sector
I. food industry
J. agricultural sales
K. production
L. social service

_____ 1. Careers requiring a fundamental knowledge of agriculture in addition to economics, business, banking, trade, and language.

_____ 2. Careers requiring a broad knowledge of agriculture, teaching skills, and a commitment to helping young people learn and develop.

_____ 3. Careers requiring a strong education in the scientific method, chemistry, nutrition, biology, and communication.

_____ 4. The foundation of the crop science industry, with careers requiring solid knowledge of agronomy, soil science, and business.

_____ 5. Careers requiring a basic knowledge of agriculture and a desire to be of service, along with skills in sales, business, marketing, advertising, computer use, and effective communications.

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_____ 6. Careers requiring a basic knowledge of crop science along with comprehension and skills in business, advertising, economics, computer science, and effective communications.

_____ 7. Offers many opportunities in processing, packaging, and distributing food that is nutritious, safe, convenient, attractive, and economical. Careers require a basic knowledge of crop science along with comprehension of marketing, advertising, sales, processing, economics, and computer science.

_____ 8. Hire employees with degrees in crop science for extension services, research, conservation, and many other areas.

OBJECTIVE 5

Evaluate requirements for a career in crop science. Write your answers in the blanks provided.

1. What two types of training are included in education and training requirements for a crop science career?

____

____

2. Many jobs require you to work and/or supervise other employees. What skills are necessary to effectively work with others?

____

____

3. What does dependability include?

____

____

4. What does professionalism include?

____

____

____

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OBJECTIVE 6 **Evaluated on Assignment Sheet 3.**

OBJECTIVE 7 **Name organizations that employ people trained in crop science.** Write the organizations in the blanks provided.

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

OBJECTIVE 8 **Evaluated on Assignment Sheet 4.**

OBJECTIVE 9 **Evaluated on Assignment Sheet 5.**

OBJECTIVE 10 **Evaluated on Assignment Sheet 6.**

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Careers in Crop Science

Job #1

Jerry is a researcher who works for a university. He is currently working on developing cultivars of crops which are more disease and insect resistant. He has regular working hours and most of his time is spent in a laboratory. He also receives a salary of $32,000 and benefits. Jerry has been working for the university for five years. Jerry has the opportunity to attend various conferences on related topics and has had several articles published. Jerry has a master's degree in agronomy.

Job #2

Mike is a farmer. He has worked on the farm for as long as he can remember. His family farmed, but his parents are now retired. Mike works long hours and must be outside a great deal of the time. Mike has both cattle and crops. He has hired several people to help him on the farm. Although the hours are often long, Mike enjoys his job. He does not receive tangible benefits such as insurance and sick days. His pay is variable but he is not under financial stress. Some years are very good and others he must take a loss.

Job #3

Debbie is a co-host for a morning agricultural television show. She does stories on issues relating to farmers in the state. She must arrive at the studio at 5:00 a.m. Debbie feels fortunate to be able to combine her interest and knowledge of agricultural with her interest in communications. She receives a salary of $28,000 and has worked for the show for three years. She also receives benefits. She has a bachelor's degree in agricultural communications.

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HANDOUT 2

Colleges and Universities

Arkansas

Arkansas State University
Plant Science Dept.
State University, AR 72467

University of Arkansas
Dept. of Agronomy
Fayetteville, AR 72701

University of Arkansas
Monticello, AR 71655

University of Arkansas
Dept. of Agriculture
Pine Bluff, AR 71601

Kansas

Fort Hays State University
Dept. of Agriculture
Hays, KS 67601

Kansas State University
Agronomy Dept.
Manhattan, KS 66506

New Mexico

New Mexico State University
Agronomy & Horticulture Dept.
Las Cruces, NM 88003

Oklahoma

Cameron University
Lawton, OK 73505

Langston University
Dept. of Agriculture
Langston, OK 73050

Oklahoma Panhandle State University
Goodwell, OK 73939

Oklahoma State University
Dept. of Agronomy
Stillwater, OK 74078

Texas

Abilene Christian University
Abilene, TX 79601

East Texas State University
Commerce, TX 75428

Prairie View A&M University
School of Agriculture
Prairie View, TX 77445

Sam Houston State University
Division of Agriculture
Huntsville, TX 77341

Southwest Texas State University
San Marcos, TX 78666

Stephen F. Austin State University
Dept. of Agriculture
Nacogdoches, TX 75962

Tarleton State University
Dept. of Agriculture
Stephenville, TX 76401

Texas A&I University
Kingsville, TX 78363

Texas A&M University
Dept. of Soil & Crop Science
College Station, TX 77843

Texas Tech University
Dept. of Agronomy, Horticulture &
Entomology
Lubbock, TX 79409

West Texas State University
Canyon, TX 79015

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LAP SHEET

SOILS

B-1

Name ____________________

Check the blank as you complete each step.

1. Take	____	the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.
2. Read	____	the introduction, unit objective, and specific objectives.
3. Do	____	the focus assignments.
4. Stop	____	and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.
5. Study	____	the Information Sheet, objective 1.
Optional: Examine	____	soil survey reports.
Optional: Obtain	____	the most current soil survey report for your location. Visit an area on the soil survey and compare the area to the soil survey.
6. Study	____	the Information Sheet, objectives 2 and 3.
Optional: Interview	____	a county extension specialist or conservation district employee about the use of soil surveys.
Optional: Read	____	*...Soil Surveys Can Help You; Farmers & Ranchers...Soil Surveys Can Help You; Land Use Planners...Soil Surveys Can Help You; Construction Engineers...Soil Surveys Can Help You;* and *Assistance Available from the Soil Conservation Service.*

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7. **Study**	____	the Information Sheet, objective 4.
Optional: Observe	____	the effects of soil water on plants by growing three plants in separate pots and watering each plant differently. Water one plant so that the soil is wet; another when the soil surface dries, and a third when the plant wilts. Record and observe differences in the plant growth.
Optional: Research	____	the different ways to measure the amount of water in soil.
8. **Study**	____	the Information Sheet, objective 5.
Optional: Review	____	the symbols for each of the essential elements.
9. **Study**	____	the Information Sheet, objectives 6 and 7.
Optional: Practice	____	determining the textural class of soils using the soil triangle.
10. **Study**	____	the Information Sheet, objective 8.
Optional: Obtain	____	samples of rocks and minerals which form soils such as sandstone, limestone, shale, quartz, gypsum, dolomite, mica, etc. Use a field guide to rocks and minerals and look up information on the rocks or minerals.
Optional: Review	____	the degrees of soil depth. Ask your instructor for the degrees of soil depth.
11. **Do**	____	the Assignment Sheet.
12. **Stop**	____	and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.
13. **Ask**	____	your instructor to demonstrate the guidelines and procedures in Job Sheet 1. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

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14. **Practice** _____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

15. **Stop** _____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

16. **Ask** _____ your instructor to demonstrate the guidelines and procedures in Job Sheet 2. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

17. **Practice** _____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

18. **Stop** _____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

19. **Take** _____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

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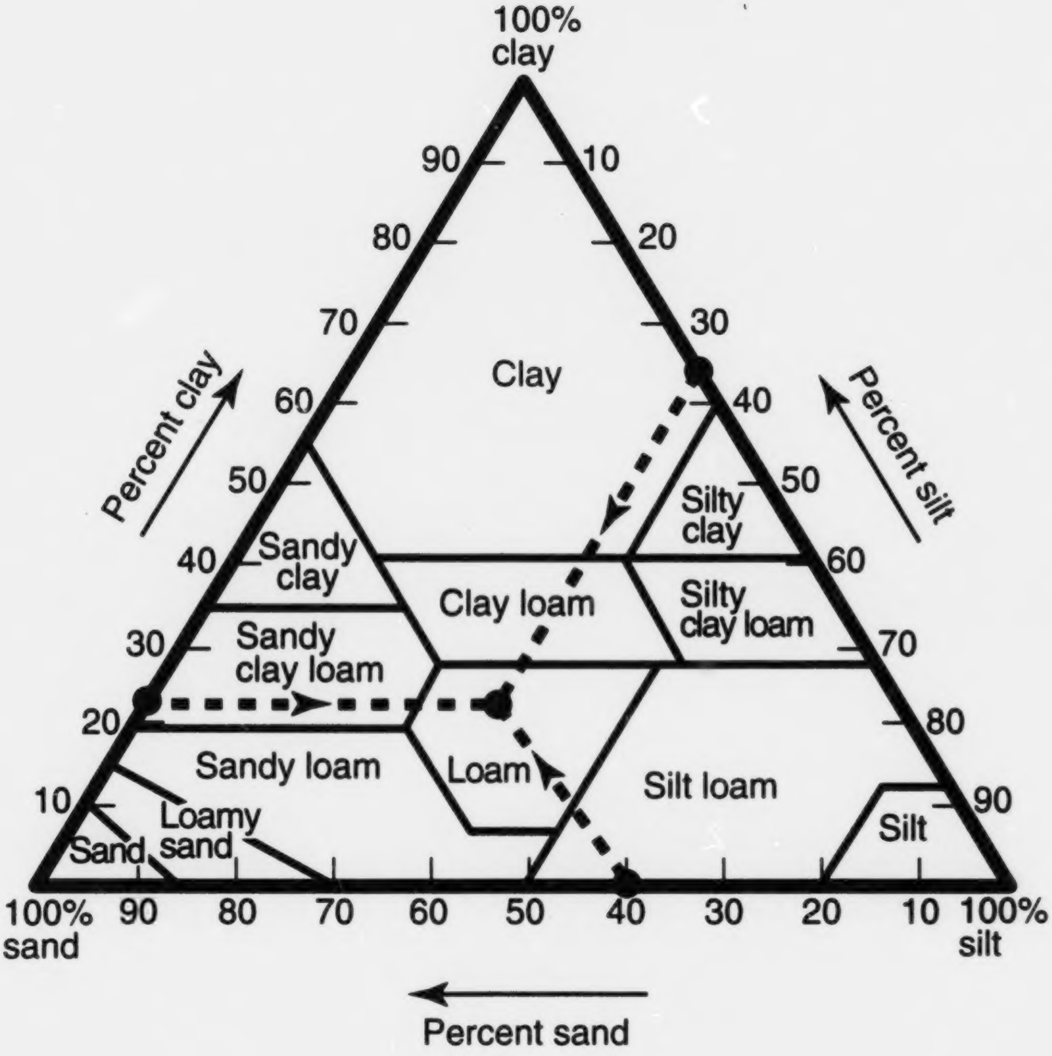
TM

SOIL TRIANGLE


100% clay
90
80
70
60
50
40
30
20
10
10
20
30
40
50
60
70
80
90
Percent clay
Percent silt
Clay
Silty clay
Sandy clay
Clay loam
Silty clay loam
Sandy clay loam
Sandy loam
Loam
Silt loam
Silt
Loamy sand
Sand
100% sand
90
80
70
60
50
40
30
20
10
100% silt
Percent sand

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WRITTEN TEST

SOILS

B-1

Name ______________________ Date __________ Score ____

OBJECTIVE 1

Describe the components of a soil survey report. Describe the four components in the blanks provided.

1. ____

____

____

____

2. ____

____

____

____

3. ____

____

____

____

4. ____

____

____

____

May be photocopied for student use.

OBJECTIVE 2

List the uses of a soil survey report. Write uses of a soil survey report in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________

OBJECTIVE 3

Name groups of people who benefit most from a soil survey report. Write groups of people in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________

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OBJECTIVE 4

Describe the types of soil water. Describe the types in the blanks provided.

1. **Saturation** – ____________________

____

____

2. **Field capacity** – ____________________

____

____

3. **Wilting point** – ____________________

____

____

____

OBJECTIVE 5

Select from a list the primary, secondary, and micronutrients found in soil. Place an "X" in front of correct answers.

PRIMARY NUTRIENTS

____ 1. Oxygen

____ 2. Nitrogen

____ 3. Carbon

____ 4. Potassium

____ 5. Phosphorus

SECONDARY NUTRIENTS

____ 6. Hydrogen

____ 7. Magnesium

____ 8. Calcium

____ 9. Sulfur

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MICRONUTRIENTS

_____ 10. Folic acid

_____ 11. Iron

_____ 12. Boron

_____ 13. Zinc

_____ 14. Riboflavin

_____ 15. Molybdenum

_____ 16. Starch

_____ 17. Chlorine

_____ 18. Copper

_____ 19. Acetate

_____ 20. Manganese

OBJECTIVE 6

Describe the soil textures. Describe the soil textures in the blanks provided.

1. ______________________________

____

____

____

2. ______________________________

____

____

____

May be photocopied for student use.

3. ______________________________

____

____

____

OBJECTIVE 7

Match soil structures to their definitions. Write the correct letter in the blank.

A. massive
B. thin
C. platy
D. blocky
E. prismatic
F. angular
G. round
H. single-grain
I. crumb
J. vertical
K. granular
L. columnar

_____ 1. Structure in which particles are grouped into very porous, irregularly sized grains

_____ 2. Structure in which particles are grouped into prismlike aggregates with a vertical axis that is longer than the horizontal axis

_____ 3. Structure in which particles are grouped into spherical aggregates with indistinct sides

_____ 4. Structure in which particles are grouped into flat, tubular aggregates with a thin vertical axis and a long horizontal axis

_____ 5. Structure in which particles are grouped into columnlike aggregates with a vertical axis that is longer than the horizontal axis

_____ 6. Structure in which particles are grouped into round (subangular) or angular aggregates with equal sides

_____ 7. Particles adhere together into a solid mass

_____ 8. Each grain behaves individually

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OBJECTIVE 8

Describe the horizons of a soil profile. Describe the horizons in the blanks provided.

1. **O Horizon** – ______________________________
2. **A Horizon** – ______________________________
3. **E Horizon** – ______________________________
4. **B Horizon** – ______________________________
5. **C Horizon** – ______________________________
6. **R Horizon** – ______________________________

OBJECTIVE 9 **Evaluated on the Assignment Sheet.**

OBJECTIVE 10 **Evaluated on Job Sheet 1.**

OBJECTIVE 11 **Evaluated on Job Sheet 2.**

330

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LAP SHEET

SOIL SAMPLING

B-2

Name ______________________________

Check the blank as you complete each step.

1. **Take** ____ the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.
2. **Read** ____ the introduction, unit objective, and specific objectives.
3. **Do** ____ the focus assignments.
4. **Stop** ____ and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.
5. **Study** ____ the Information Sheet, objective 1.

Optional: Interview ____ a local county extension agent about soil testing.

6. **Study** ____ the Information Sheet, objective 2.

Optional: Read ____ *OSU Soil Test Interpretations*, OSU Extension Facts No. 2225.

Optional: Review ____ the chemical symbols of the elements.

Optional: Refer ____ to agricultural textbooks and review the sections on the nutrients which plants receive from soils.

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7. **Study** ____ the Information Sheet, objective 3.

Optional: Read ____ *Soil pH and Buffer Index*, OSU Extension Facts No. 2229.

Optional: Research ____ specific plants and determine the soil pH ranges which are suitable to the plants.

8. **Study** ____ the Information Sheet, objective 4.

Optional: Examine ____ soil from areas from which samples should not be taken and compare them visually with samples from appropriate areas.

9. **Study** ____ the Information Sheet, objective 5.

Optional: Examine ____ examples of the different tools.

10. **Study** ____ the Information Sheet, objectives 6-7.

Optional: Read ____ *How to Get a Good Soil Sample*, OSU Extension Fact Sheet No. 2207.

11. **Ask** ____ your instructor to demonstrate the guidelines and procedures in Job Sheet 1. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

12. **Practice** ____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

13. **Stop** ____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

14. **Do** ____ Assignment Sheet 1.

15. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

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16. Take ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

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WRITTEN TEST

SOIL SAMPLING

B-2

Name ______________________ Date __________ Score ___

OBJECTIVE 1

List reasons for testing soil. Write the reasons in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________

OBJECTIVE 2

Name the major items for which soils are tested. Write the items in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________

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OBJECTIVE 3

Label a soil pH scale. Write the correct answers in the blanks provided.

pH scale	**Soil Characteristic**
3.5	1. ______________________________ ______________________________
4.0	2. ______________________________
4.5	
5.0	
5.5	3. ______________________________
6.0	
6.5	4. ______________________________
7.0	5. ______________________________
7.5	6. ______________________________
8.0	7. ______________________________
8.5	
9.0	8. ______________________________
10.0	
10.5	9. ______________________________ ______________________________

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OBJECTIVE 4

Select from a list areas from which soil samples should not be taken. Write an "X" in the blanks in front of areas from which soil samples should **NOT** be taken.

____ 1. The middle of the field

____ 2. Dirt roads

____ 3. Eroded spots

____ 4. Level areas of the field

____ 5. Areas with visible differences in soils

____ 6. Areas which have been grazed

____ 7. Fertilizer spills

____ 8. Areas in a field that have been manured, limed, or treated differently

____ 9. Small depressions or low spots

____ 10. Large areas of similar soil type

____ 11. Barns

____ 12. Fence rows

____ 13. Small areas of noticeable differences in crop growth within a field

____ 14. Large areas that are fenced

____ 15. Dead furrows

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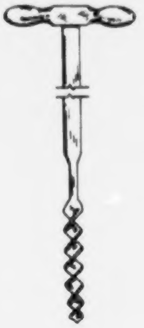
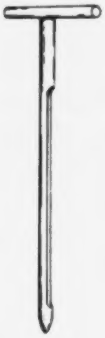
OBJECTIVE 5

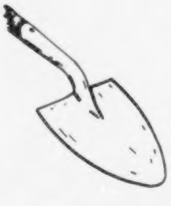
Identify tools used to collect soil samples. Write the name of the tool in the blanks provided.



1. ____________________



2. ____________________



3. ____________________

May be photocopied for student use.

OBJECTIVE 6

List the steps for collecting a soil sample. Write the steps in the blanks provided.

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

OBJECTIVE 7

Name locations in Oklahoma where soil samples can be sent for testing. Write the locations in the blanks provided.

1. ______________________________

2. ______________________________

3. ______________________________

OBJECTIVE 8

Evaluated on the Job Sheet.

OBJECTIVE 9

Evaluated on the Assignment Sheet.

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LAP
SHEET

FERTILIZERS AND IRRIGATION

B-3

Name ____________________

Check the blank as you complete each step.

1. **Take** ____ the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

2. **Read** ____ the introduction, unit objective, and specific objectives.

3. **Do** ____ the focus assignments.

4. **Stop** ____ and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.

5. **Study** ____ the Information Sheet, objectives 1-2.

Optional: Observe ____ examples of the three categories of fertilizers.

Optional: Write ____ a short paper on the advantages and disadvantages of the different types of fertilizers.

Optional: Research ____ the use of sludge in your state or region.

6. **Study** ____ the Information Sheet, objectives 3-4.

Optional: Research ____ the advantages and disadvantages of the different forms of fertilizers.

Optional: Observe ____ examples of the different forms of fertilizers.

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7. Study	____	the Information Sheet, objective 5.
Optional: Interview	____	a local county extension agent, crop producer, or chemical sales representative about the different fertilization methods.
8. Study	____	the Information Sheet, objective 6.
Optional: Observe	____	fertilizer equipment and write a brief paper on why you believe it is important to properly care for the equipment.
9. Study	____	the Information Sheet, objective 7.
Optional: Review	____	the chemical abbreviations of nutrients and the different terms that may be used to apply to various nutrients. For example, potassium may be referred to as potash.
10. Study	____	the Information Sheet, objectives 8-10.
Optional: Read	____	*Sulfur Requirements of Oklahoma Crops*, OSU Extension Facts F-2237 and *Use of Fertilizer on Cotton*, OSU Extension Facts F-2210.
Optional: Observe	____	examples of plants with nutrient deficiencies.
11. Study	____	the Information Sheet, objective 11.
Optional: Read	____	*Anhydrous Ammonia Safety*, OSU Extension Facts F-1723.
12. Study	____	the Information Sheet, objective 12.
Optional: Read	____	*The Oklahoma Fertilizer Law*, OSU Extension Facts F-2233.
Optional: Find	____	the required information on fertilizer labels.

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13. **Study** ____ the Information Sheet, objectives 13-14.

Optional: Calculate ____ fertilizer ratios from different fertilizers.

Optional: Determine ____ the percentages of nitrogen, phosphate, and potash in different fertilizers.

14. **Study** ____ the Information Sheet, objectives 15-16.

Optional: Grow ____ two plants of the same type in different soils: one with the correct pH and the other with incorrect pH. Observe any differences in growth.

Optional: Read ____ *Managing Acid Soils for Wheat Production*, OSU Extension Facts F-2240.

Optional: Research ____ soil acidification and write a brief report on your findings.

15. **Do** ____ Assignment Sheet 1.

16. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

17. **Do** ____ Assignment Sheet 2.

18. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

19. **Do** ____ Assignment Sheet 3.

20. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

21. **Do** ____ Assignment Sheet 4.

22. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

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23. **Do** ____ Assignment Sheet 5.

24. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

25. **Do** ____ Assignment Sheet 6.

26. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

27. **Do** ____ Assignment Sheet 7.

28. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

29. **Do** ____ Assignment Sheet 8.

30. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

31. **Ask** ____ your instructor to demonstrate the guidelines and procedures in Job Sheet 1. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

32. **Practice** ____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

33. **Stop** ____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

34. **Study** ____ the Information Sheet, objectives 26-28.

Optional: Read ____ *Classification of Irrigation Water Quality*, OSU Extension Facts No. 2401 and *Irrigation Water Qualities*, OSU Extension Facts No. 2404.

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Optional: Research ____ irrigation in areas where water conservation is very important. Write a short paper on the pros and cons of irrigating in areas where water is not abundant.

Optional: Observe ____ irrigation systems.

Optional: Watch ____ the video *Irrigation Techniques in Agriculture.*

35. Do ____ Assignment Sheet 9.

36. Stop ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

37. Do ____ Assignment Sheet 10.

38. Stop ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

39. Take ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

WRITTEN TEST

FERTILIZERS AND IRRIGATION

B-3

Name ______________________ Date __________ Score ____

OBJECTIVE 1

List factors that influence the use of fertilizers. Write the factors in the blanks provided.

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________

OBJECTIVE 2

Describe categories of fertilizers. Write the descriptions in the blanks provided.

1. ______________________

____

____

____

2. ______________________

____

____

____

May be photocopied for student use.

3. ____

____

____

____

OBJECTIVE 3

Describe the forms in which fertilizers are provided. Write the descriptions in the blanks provided.

1. ____

____

____

____

2. ____

____

____

____

3. ____

____

____

____

4. ____

____

____

____

May be photocopied for student use.

OBJECTIVE 4

Define green manures. Write the definition in the blanks provided.

____

____

____

OBJECTIVE 5

Match methods of applying fertilizers to their descriptions. Write the correct letters in the blanks.

A. fertigation
B. foliar
C. row dressing
D. starter
E. sheet
F. broadcast
G. water injection
H. soil injection
I. row placement (band)
J. beginning fertilization
K. top dressing
L. side dressing

_____ 1. Fertilizer is applied in the row with the seed at the time of seeding for immediate use by the young seedling

_____ 2. Fertilizer is uniformly spread over the soil by the use of equipment or aircraft

_____ 3. Fertilizers are injected into the soil

_____ 4. Application of liquid fertilizer directly on the foliage of the plants

_____ 5. Application of fertilizer in irrigation systems

_____ 6. Application of fertilizer to one side and below the level of the seed

_____ 7. Application of fertilizer along the crop row

_____ 8. Application of fertilizer over a growing crop

May be photocopied for student use.

OBJECTIVE 6

Name factors to consider in caring for fertilizer equipment. Write the factors in the blanks provided.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________

OBJECTIVE 7

Match the primary plant nutrients to their characteristics. Write an "N" before nitrogen characteristics, a "P" before phosphorus characteristics, and a "K" before potassium characteristics in the blanks provided. Some blanks may have more than one answer.

_____ 1. Is part of all living plant cells

_____ 2. Aids in cell division and reproduction

_____ 3. Aids in fruiting and seed production

_____ 4. Increases crop yields

_____ 5. Produces plumper seed

_____ 6. Helps in translocation from the leaves to the roots

_____ 7. Stimulates root growth

_____ 8. Gives dark green color because of chlorophyll production

_____ 9. Influences the transpiration rate by regulating the stoma

_____ 10. Speeds crop maturity

_____ 11. Increases the proportion of water in plant tissues

_____ 12. Increases protein content of plant tissue

_____ 13. Promotes tougher growth and strong stems which reduces lodging

_____ 14. Helps plants resist cold and disease

_____ 15. Promotes health and vigor of plants

May be photocopied for student use.

OBJECTIVE 8

Match the secondary plant nutrients to their characteristics. Write a "C" before calcium characteristics, an "M" before magnesium characteristics, and an "S" before sulfur characteristics.

____ 1. Controls soil pH

____ 2. Promotes root and leaf growth

____ 3. Aids seed production

____ 4. Necessary for making chlorophyll

____ 5. Aids in the uptake of phosphorus

____ 6. Aids in the movement of starch

____ 7. Essential ingredient in chlorophyll

____ 8. Helps plants build cell walls

____ 9. Regulates the uptake of other plant nutrients

____ 10. Makes cells more selective in absorption of nutrients

____ 11. Aids in nodule formation on legumes

____ 12. Is important in plant enzyme system

____ 13. Aids in the formation of fats and oils

____ 14. Stimulates more vigorous plant growth

____ 15. Is necessary for the nodule formation of legumes

____ 16. Aids in protein formation and carbohydrate movement

OBJECTIVE 9

Name the micronutrients essential to plant growth. Write the micronutrients in the blanks provided.

1. ____

2. ____

3. ____

4. ____

May be photocopied for student use.

5. ____

6. ____

7. ____

OBJECTIVE 10

Match nutrients to their deficiency symptoms. Write the correct letters in the blanks. Some letters may be used more than once.

A. sulfur
B. boron
C. nitrogen
D. calcium
E. phosphorus
F. magnesium
G. manganese
H. potassium

_____ 1. Stunted growth

_____ 2. Chlorosis

_____ 3. Older leaves are pale green

_____ 4. Problems with shoot tips

_____ 5. Slow growth and stunting

_____ 6. Purple tint to the leaves and stems

_____ 7. Burnt appearance on the edges of lower leaves

_____ 8. Stunted growth but plant remains green

OBJECTIVE 11

Explain the Haber process of manufacturing nitrogen fertilizers. Write a brief explanation of the Haber process in the blanks provided.

____

____

____

____

____

____

May be photocopied for student use.

____

____

____

____

OBJECTIVE 12

Select from a list information that must appear on fertilizer bags according to state law. Write an "X" in front of correct answers.

____ 1. Brand name and grade of commercial fertilizer

____ 2. Estimated crop yields from use of the fertilizer

____ 3. Name and address of the registrant or the person guaranteeing the commercial fertilizer

____ 4. Guaranteed analysis showing the minimum percentage of plant food claimed in the following order and form: Soluble Potash (K_2O) percent, Total Nitrogen (N) percent, and Available Phosphoric Acid (P_2O_5) percent

____ 5. Net weight of the contents of the package or parcel

____ 6. Guaranteed analysis showing the minimum percentage of plant food claimed in the following order and form: Total Nitrogen (N) percent, Available Phosphoric Acid (P_2O_5) percent, and Soluble Potash (K_2O) percent

OBJECTIVE 13

Define fertilizer ratio. Write the definition in the blanks provided.

____

____

____

May be photocopied for student use.

OBJECTIVE 14

Discuss the percent nutrient value of fertilizers. Answer the questions below in the blanks provided.

1. What does the fertilizer grade indicate?

   ____

   ____

2. How is the grade stated?

   ____

   ____

3. What percent nutrients is a fertilizer with a grade of 20-10-10?

   ____

   ____

   ____

4. What makes up the remaining percentage of the fertilizer?

   ____

   ____

   ____

May be photocopied for student use.

OBJECTIVE 15

Complete a chart on the most desirable pH scale range for crops. Complete the chart below.

Crop	**pH Range**
Crimson clover, vetch	1.
Peanuts, soybeans	2.
Alsike, red, and white clovers	3.
Alfalfa, sweet clover	4.
Bluestem, fescue, native hay, weeping lovegrass	5.
Corn, oats, orchardgrass, ryegrass, sorghum, wheat	6.
Bermudagrass	7.
Barley	8.
Cotton	9.

OBJECTIVE 16

Select from a list the benefits of a liming program. Write an "X" in front of correct answers.

_____ 1. Supplies calcium to plants

_____ 2. Increases available water use for plants

_____ 3. Raises soil pH

_____ 4. Supplies boron and copper to plants

_____ 5. Allows the best crop yields from the finances put into fertilizers

_____ 6. Removes aluminum toxicity and promotes the activities of desirable organisms

_____ 7. Decreases calcium available to plants

_____ 8. Increases crop response to fertilizers by improving the uptake of primary nutrients

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OBJECTIVE 17	**Evaluated on Assignment Sheet 1.**
OBJECTIVE 18	**Evaluated on Assignment Sheet 2.**
OBJECTIVE 19	**Evaluated on Assignment Sheet 3.**
OBJECTIVE 20	**Evaluated on Assignment Sheet 4.**
OBJECTIVE 21	**Evaluated on Assignment Sheet 5.**
OBJECTIVE 22	**Evaluated on Assignment Sheet 6.**
OBJECTIVE 23	**Evaluated on Assignment Sheet 7.**
OBJECTIVE 24	**Evaluated on Assignment Sheet 8.**
OBJECTIVE 25	**Evaluated on Job Sheet 1.**
OBJECTIVE 26	**List factors which determine whether or not irrigation is feasible.** Write six factors in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________

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OBJECTIVE 27

Match types of irrigation systems to their descriptions. Write the correct letters in the blanks.

A. border irrigation
B. trickle irrigation
C. total irrigation
D. flood irrigation
E. surge irrigation
F. furrow irrigation
G. row irrigation
H. corrugation irrigation
I. broadcast irrigation
J. sprinkler irrigation

_____ 1. Water flows by gravity from a main ditch and down the furrows, generally between each two rows of crops

_____ 2. Overhead application of water in simulated rainfall

_____ 3. Covering a field with several inches or centimeters of water at one time

_____ 4. Narrow and closely spaced furrows are made on contours across a field; water soaks into the soil along the furrows

_____ 5. Narrow strips of land are leveled across the slope and a low ridge is built up and down the slope to hold water; each strip is irrigated by flooding

_____ 6. Intermittent application of water to furrows in surges

_____ 7. Frequent, slow application of water through plastic tubing at low water pressure; water drips from emitters (outlets) at intervals along the delivery lines

OBJECTIVE 28

Explain the principles of fertigation. Answer the questions in the blanks provided.

1. What is fertigation?

____

____

2. What are the principal nutrients supplied by fertigation?

____

May be photocopied for student use.

3. What are the advantages of fertigation?

____

____

____

____

OBJECTIVE 29 **Evaluated on Assignment Sheet 9.**

OBJECTIVE 30 **Evaluated on Assignment Sheet 10.**

May be photocopied for student use.

LAP
SHEET

SOIL CONSERVATION PRACTICES

B-4

Name ______________________________

Check the blank as you complete each step.

1. **Take**	____	the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.
2. **Read**	____	the introduction, unit objective, and specific objectives.
3. **Do**	____	the focus assignments.
4. **Stop**	____	and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.
5. **Study**	____	the Information Sheet, objective 1.
Optional: Find	____	examples of erosion in your area.
Optional: Read	____	Natural Resources Conservation Service publications on erosion.
Optional: Interview	____	a knowledgeable individual about erosion.
6. **Study**	____	the Information Sheet, objective 2.
Optional: Observe	____	sites in your area and determine the degree of erosion.

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7. Study	____	the Information Sheet, objective 3.
Optional: Observe	____	sites in your area and determine the category of water erosion.
8. Study	____	the Information Sheet, objectives 4 and 5.
Optional: Read	____	Natural Resources Conservation Service publications on erosion.
Optional: Interview	____	a soil conservation specialist.
Optional: Write	____	a short paper on the importance of soil conservation. Give a brief oral report on your findings to the class.
9. Study	____	the Information Sheet, objective 6.
Optional: Observe	____	fields which have artificial drainage.
10. Study	____	the Information Sheet, objectives 7 and 8.
Optional: Read	____	OSU publications CR 1213, *Understanding "Lo-Till" Planters*; F-1221, *Planting and Conservation Tillage*; and CR-2900, *Evaluating Lo-Till Demonstrations* and applicable NRCS publications.
Optional: Observe	____	fields which have been farmed under various tillage methods.
Optional: Write	____	a report comparing conventional and conservation tillage. Include advantages and disadvantages of each method.
11. Do	____	Assignment Sheet 1.
12. Stop	____	and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

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13. **Do** ____ Assignment Sheet 2.

14. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

15. **Take** ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

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SOIL CONSERVATION PRACTICES

B-4

Name ______________________ Date __________ Score ____

OBJECTIVE 1

Describe the effects of wind and water erosion. Write the answers to the questions in the blanks provided.

1. Why is soil erosion a concern for bodies of water such as rivers and lakes?

____

____

____

2. What problems can soil sediment create?

____

____

____

____

3. What problems can severe erosion create when operating farm equipment?

____

____

4. What does erosion do to the soil profile and the root zone?

____

____

____

May be photocopied for student use.

5. What is lost when the topsoil is eroded?

____

____

6. Why is the erosion of topsoil a major concern for growing plants?

____

____

OBJECTIVE 2

Match degrees of erosion to their correct definitions. Write the correct letters in the blanks.

A. severe
B. minor
C. extreme
D. very severe
E. none to slight
F. moderate

____ 1. Degree of erosion in which 25 to 75 percent of the surface soil has been removed, with or without gullies, and with a plow layer that consists of a mixture of the surface A horizon and underlying B horizon

____ 2. Degree of erosion in which 75 percent or more of the surface soil has been removed, with frequent uncrossable gullies less than 100 feet apart and/or severe accumulation by wind, and with a plow layer that exhibits characteristics similar to severely eroded soil

____ 3. Degree of erosion in which less than 25 percent of the surface soil has been removed, with no gullies, and with a plow layer that exhibits characteristics of the A horizon

____ 4. Degree of erosion in which 75 percent or more of the surface soil has been removed, with occasional uncrossable gullies more than 100 feet apart and/or severe accumulation by wind, and with a plow layer that exhibits predominantly B horizon characteristics

May be photocopied for student use.

OBJECTIVE 3 **Match categories of water erosion to their correct definitions.**

A.	sheet erosion	E.	till erosion
B.	river erosion	F.	rill erosion
C.	gully erosion	G.	streambank erosion
D.	splash erosion	H.	blanket erosion

_____ 1. Soil that is directly moved by a raindrop splash

_____ 2. Erosion that occurs when the banks of a stream erode because of flowing water

_____ 3. The removal of a relatively uniform thin layer of soil

_____ 4. Surface runoff water accumulates into small channels on slopes; can be filled in by tillage

_____ 5. Surface runoff water accumulates in channels that become deeper and wider; cannot be crossed by farm equipment

OBJECTIVE 4 **List management practices that aid in water erosion control.** Write the practices in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________

May be photocopied for student use.

OBJECTIVE 5

Select from a list management practices that control wind erosion. Place an "X" in front of correct answers.

____ 1. Keeping soil covered with vegetation or mulch

____ 2. Conservation tillage

____ 3. Remove all plants from the topsoil

____ 4. Increase soil surface roughness by establishing ridges through tillage implements

____ 5. Conventional tillage

____ 6. Planting windbreaks of trees and large shrubs

OBJECTIVE 6

Describe benefits of artificial drainage. Answer the following questions in the blanks provided.

1. In what three ways does artificial drainage improve the soil?

2. How does artificial drainage decrease soil erosion?

3. Name three ways in which artificial drainage allows soils to be more productive.

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4. How does artificial drainage increase the amount of nutrients available to plants?

5. Name three ways that artificial drainage decreases damage to plants or plant roots.

May be photocopied for student use.

OBJECTIVE 7 **Define conservation tillage.** Define conservation tillage in the blanks provided.

OBJECTIVE 8 **Explain the principles of conservation tillage.** Explain the three main principles of conservation tillage in the blanks provided.

1. ______________________________

2. ______________________________

3. ______________________________

OBJECTIVE 9 **Evaluated on Assignment Sheet 1.**

OBJECTIVE 10 **Evaluated on Assignment Sheet 2.**

May be photocopied for student use.

LAP SHEET

LAND USES AND CLASSIFICATION

C-1

Name ______________________________

Check the blank as you complete each step.

1. **Take**	____	the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.
2. **Read**	____	the introduction, unit objective, and specific objectives.
3. **Do**	____	the focus assignments.
4. **Stop**	____	and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.
5. **Study**	____	the Information Sheet, objective 1.
Optional: Interview	____	a county extension agent or other knowledgeable person about land judging.
6. **Study**	____	the Information Sheet, objective 2.
Optional: Write	____	a short paragraph discussing each of the factors.
7. **Study**	____	the Information Sheet, objective 3.
Optional: Examine	____	soils that have different degrees of permeability.
Optional: Refer	____	to textbooks on land uses and classifications or land judging guidelines for further information.

May be photocopied for student use.

8. **Study** ____ the Information Sheet, objectives 4 and 5.

Optional: Refer ____ to textbooks on land uses and classifications or land judging guidelines for further information.

9. **Study** ____ the Information Sheet, objective 6.

Optional: Write ____ down areas of land you are familiar with and classify them according to suitable use.

10. **Study** ____ the Information Sheet, objective 7.

Optional: Refer ____ to textbooks on land uses and classifications for further information.

11. **Study** ____ the Information Sheet, objectives 8-10.

Optional: Write ____ a short paper on why management abilities such as evaluating, planning, organizing, and taking action are important when dealing with land treatments.

12. **Study** ____ the Information Sheet, objective 11.

Optional: Refer ____ to textbooks on land uses and classifications or land judging guidelines for further information.

13. **Do** ____ Assignment Sheet 1.

14. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

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15. **Do** ____ Assignment Sheet 2.

16. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

17. **Take** ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

May be photocopied for student use.

WRITTEN TEST

LAND USES AND CLASSIFICATION

C-1

Name ______________________ Date __________ Score ____

OBJECTIVE 1

Name reasons for judging land. Write the reasons in the blanks provided.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________

OBJECTIVE 2

List factors that determine land capability class. Write the factors in the blanks provided.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________

May be photocopied for student use.

OBJECTIVE 3

Match degrees of permeability to their correct soil characteristics. Write the correct letters in the blanks.

A. slow permeability
B. intense permeability
C. rapid permeability
D. very rapid permeability
E. very slow permeability
F. moderate permeability

_____ 1. Soils that have dense, fine clay, or claypan subsoils with a plate-like, coarse, blocky, or massive structure

_____ 2. Soils that have loose or open sandy subsoils

_____ 3. Soils that have clayey subsoils and are medium, blocky, to somewhat crumbly

_____ 4. Soils that have highly granular, blocky, or columnar clay loam subsoils

OBJECTIVE 4

Match rates of surface runoff to their correct definitions. Write the correct letters in the blanks.

A. slow
B. rapid
C. very slow
D. very rapid
E. intense
F. moderate

_____ 1. Surface water flows away slowly

_____ 2. Surface water flows rapidly over the surface of fields with a slope of 3 percent or above

_____ 3. Surface water flows away very slowly and soil may remain wet for long periods of time

_____ 4. Surface water flows away at what is considered a normal rate over fields with slopes of 1 to 3 percent

May be photocopied for student use.

OBJECTIVE 5

Match land capability classes to their correct definitions.

A. I
B. II
C. III
D. IV
E. V
F. VI
G. VII
H. VIII

____ 1. These soils have mild limitations and require moderate conservation practices

____ 2. These soils have few limitations and can be used year after year for agricultural production with little treatment and proper agricultural practices

____ 3. These soils have such severe limitations that they cannot be used for commercial plant production and their use must be extremely limited

____ 4. These soils have severe limitations and require special conservation practices

____ 5. These soils have very severe limitations and require greater conservation practices

____ 6. These soils have severe limitations such as steep slopes or shallow soils and require special management practices

____ 7. These soils have little erosion hazard but have other limitations that make them impractical for cultivation

____ 8. These soils have very severe limitations that require careful management to protect the soil

May be photocopied for student use.

OBJECTIVE 6

Complete a chart on correct suitable uses of land capability classes. Complete the chart below by placing an "X" in the correct squares.

	Class							
	I	II	III	IV	V	VI	VII	VIII
Crop production								
Hay								
Pasture								
Range								
Woodland								
Wildlife								
Watershed								
Recreation								

May be photocopied for student use.

OBJECTIVE 7

Complete a chart on the best land capability class possible for certain soil factors. Complete the chart below by writing in the best land capability class possible.

Land Capability Factor	Soil Factor	Best Land Class
Texture	Coarse Moderately coarse, medium, moderately fine, fine	
Depth	Deep, moderately deep Shallow Very Shallow	
Permeability	Rapid Moderate, slow Very slow	
Slope	Nearly level (0% to 1%) Gently sloping (1% to 3%) Moderately sloping (3% to 5%) Strongly sloping (5% to 8%) Steep (8% to 15%), very steep (15% and over)	
Erosion	None to slight Moderate Severe, very severe	
Surface runoff	Rapid Moderate, slow Very slow	

OBJECTIVE 8

List recommended land treatments applied to land capability classes. Write the answers in the blanks provided.

1. ______________________________

2. ______________________________

3. ______________________________

May be photocopied for student use.

OBJECTIVE 9

Match types of vegetative practices to the correct land capability classes each is applied to. Write the correct letters in the blanks. Answers may be used more than once.

A. I	E. V
B. II	F. VI
C. III	G. VII
D. IV	H. VIII

_____ 1. Row cropping with occasional soil conserving crop

_____ 2. Row cropping with frequent soil conserving crop

_____ 3. Row cropping not more than one out of five years

_____ 4. Row cropping not more than two out of four years

_____ 5. Establishing wildlife or recreation areas

_____ 6. Returning crop residue to soil

_____ 7. Practicing conservation tillage

_____ 8. Practicing selective harvesting

_____ 9. Planting recommended trees

_____ 10. Establishing recommended grasses and legumes

_____ 11. Protecting from burning

_____ 12. Practicing control grazing

_____ 13. Practicing proper pasture and range management

May be photocopied for student use.

OBJECTIVE 10

Match types of mechanical treatments to their correct uses. Write the correct letters in the blanks.

A. No treatment needed
B. Controlling rainfall
C. Controlling brush and trees
D. Controlling gullies
E. Maintaining terraces
F. Installing drainage system
G. Terracing and farming on contour
H. Constructing diversion terraces

_____ 1. Used when active gullies are a problem

_____ 2. Used on all land capability classes except Class VIII

_____ 3. Used on land capability classes II, III, and IV

_____ 4. Used when brush and trees, erosion, gullies, drainage, or outside water are not problems

_____ 5. Used where wetness is a factor

_____ 6. Used any time terracing and farming on contour are recommended

_____ 7. Used whenever field has overhead water problem

OBJECTIVE 11

Match factors that affect land capability class to the correct land treatments applied to each. Write the correct letters in the blanks. Some items may have more than one response.

A. timber production
B. needs windbreak
C. wetness
D. desires post lot or wood lot
E. frequently flooded
F. overhead water
G. extremely dry

_____ 1. Planting recommended trees; practicing selective harvesting of trees; protecting from burning

_____ 2. Installing drainage system

_____ 3. No mechanical treatment applies

_____ 4. Planting recommended trees; protecting from burning

_____ 5. Constructing diversion terraces

May be photocopied for student use.

OBJECTIVE 12 Evaluated on Assignment Sheet 1.

OBJECTIVE 13 Evaluated on Assignment Sheet 2.

375

May be photocopied for student use.

LAP SHEET

LEGAL LAND DESCRIPTIONS

C-2

Name ______________________________

Check the blank as you complete each step.

1. Take	____	the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.
2. Read	____	the introduction, unit objective, and specific objectives.
3. Do	____	the focus assignments.
4. Stop	____	and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.
5. Study	____	the Information Sheet, objective 1.
Optional: Write	____	a short essay on what problems might occur if landowners are not clear about the boundaries of their land.
Optional: Research	____	the types of legal land descriptions used in your county.
Optional: Visit	____	the county courthouse and look up deeds and land descriptions.
Optional: Research	____	items that coincide with legal land descriptions such as easements, covenants, and restrictions on land.
Optional: Read	____	OSU Fact Sheet AF-156, *Considerations in Negotiating Land Easements.*

May be photocopied for student use.

Optional: Interview ____ a surveyor about land location and using legal land descriptions.

6. **Study** ____ the Information Sheet, objectives 2-3.

7. **Ask** ____ your instructor to show you a transparency illustrating rectangular system and subdivisions.

Optional: Locate ____ your quadrangle, township, and range.

Optional: Locate ____ markers or monuments in your area.

8. **Study** ____ the Information Sheet, objective 4.

Optional: Practice ____ reading legal land descriptions.

9. **Study** ____ the Information Sheet, objective 5.

10. **Ask** ____ your instructor to show you a transparency illustrating the principal meridians, base lines, and initial points.

Optional: Identify ____ the guide meridians and standard parallels nearest to your area.

11. **Do** ____ Assignment Sheet 1.

12. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

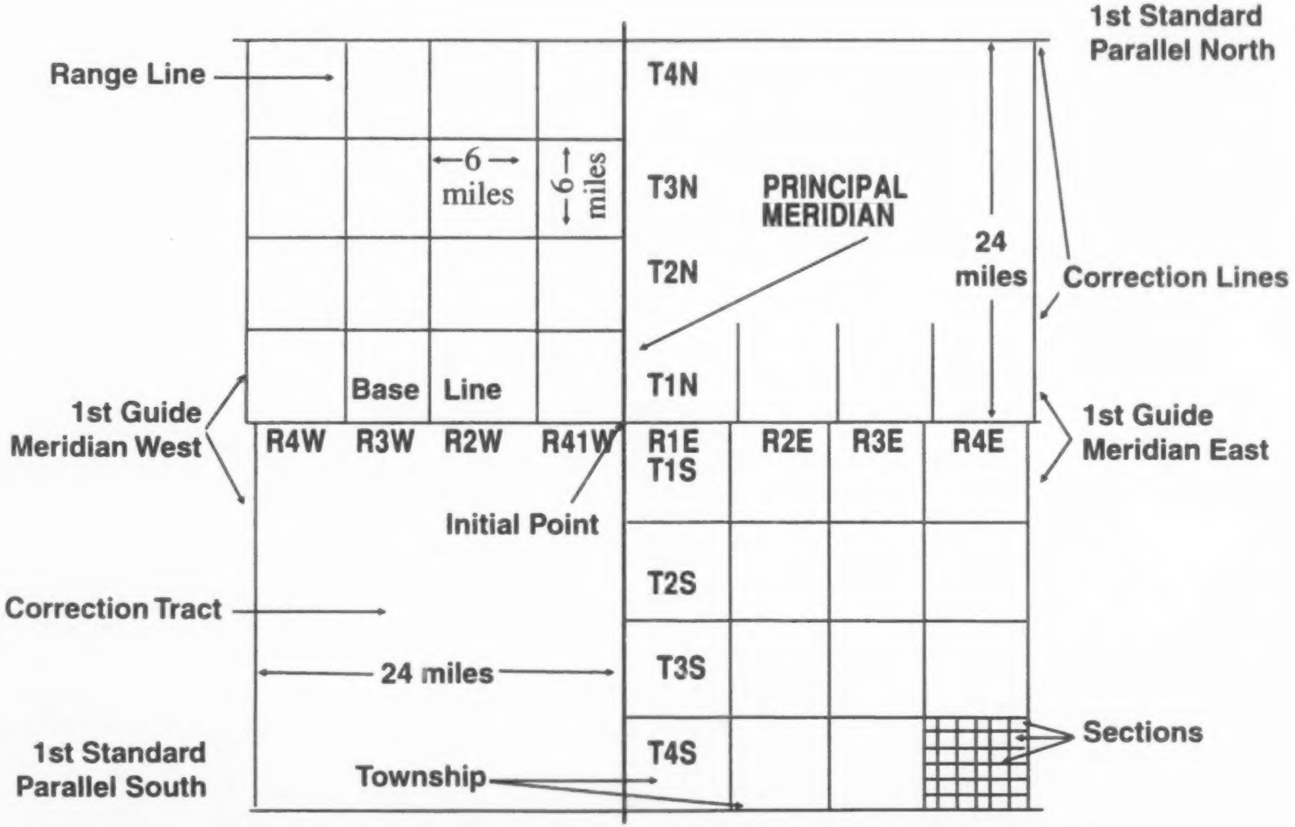
13. **Do** ____ Assignment Sheet 2.

14. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

15. **Take** ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

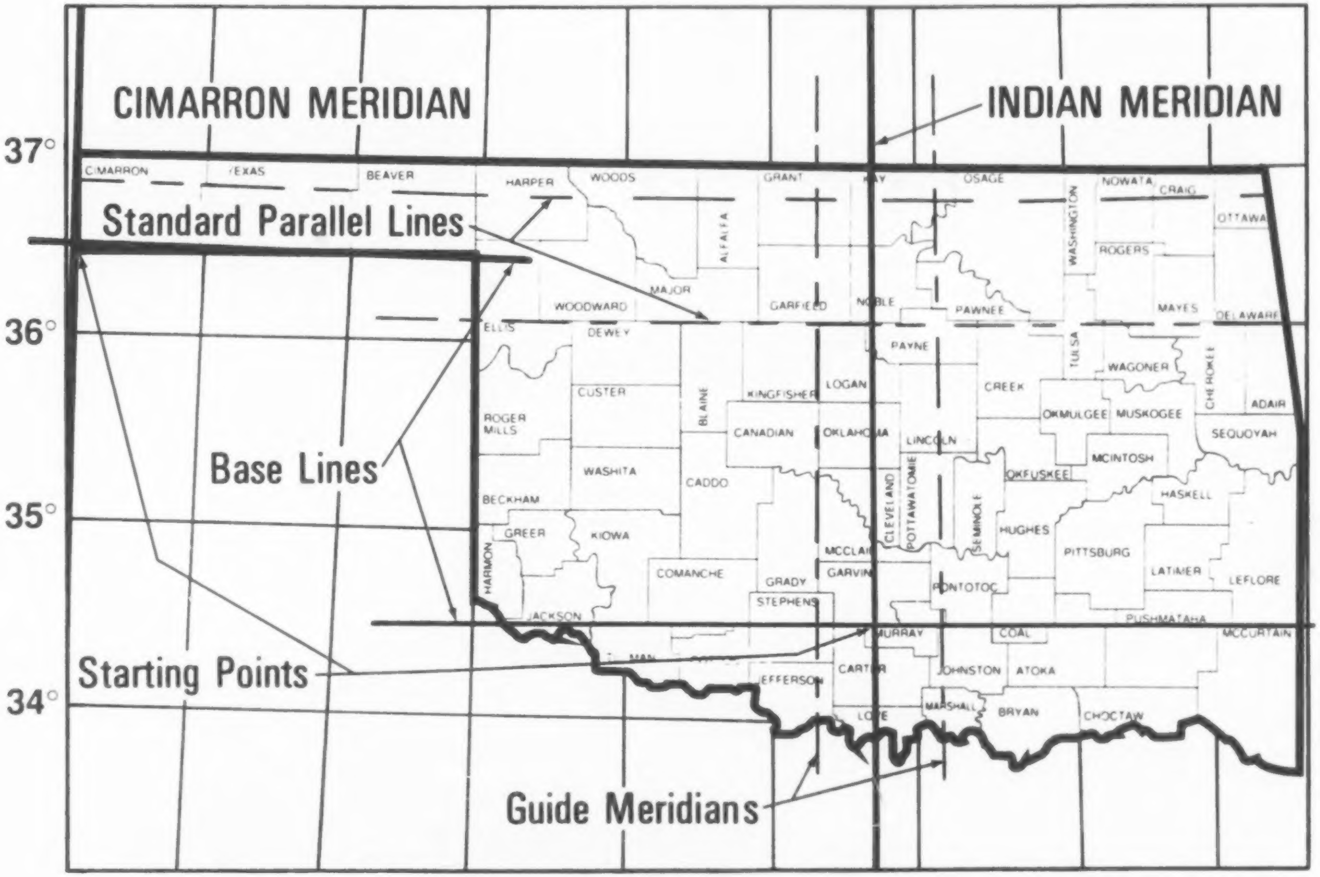
May be photocopied for student use.

Rectangular System Subdivisions


1st Standard Parallel North
Range Line
T4N
T3N
T2N
T1N
←6→ miles
←6→ miles
PRINCIPAL MERIDIAN
24 miles
Correction Lines
Base Line
1st Guide Meridian West
1st Guide Meridian East
R4W
R3W
R2W
R41W
R1E
T1S
R2E
R3E
R4E
Initial Point
T2S
Correction Tract
24 miles
T3S
Sections
T4S
1st Standard Parallel South
Township

The location of the initial point, base line, principal meridian, standard parallels, guide meridians, ranges, townships, and sections.

Principal Meridians and Base Lines


CIMARRON MERIDIAN
INDIAN MERIDIAN
37°
36°
35°
34°
Standard Parallel Lines
Base Lines
Starting Points
Guide Meridians
CIMARRON
TEXAS
BEAVER
HARPER
WOODS
ALFALFA
GRANT
KAY
OSAGE
WASHINGTON
NOWATA
CRAIG
OTTAWA
ROGERS
MAJOR
WOODWARD
GARFIELD
NOBLE
PAWNEE
MAYES
DELAWARE
ELLIS
DEWEY
PAYNE
TULSA
WAGONER
CHEROKEE
CUSTER
BLAINE
KINGFISHER
LOGAN
CREEK
OKMULGEE
MUSKOGEE
ADAIR
ROGER MILLS
CANADIAN
OKLAHOMA
LINCOLN
MCINTOSH
SEQUOYAH
WASHITA
CADDO
OKFUSKEE
HASKELL
BECKHAM
CLEVELAND
POTTAWATOMIE
SEMINOLE
GREER
KIOWA
HUGHES
PITTSBURG
HARMON
COMANCHE
GRADY
MCCLAIN
GARVIN
PONTOTOC
LATIMER
LEFLORE
STEPHENS
JACKSON
MURRAY
COAL
PUSHMATAHA
MCCURTAIN
CARTER
JOHNSTON
ATOKA
JEFFERSON
LOVE
MARSHALL
BRYAN
CHOCTAW

Location of the two principal meridians (—) and base lines (—) in Oklahoma. Two guide meridians (— - —) and two standard parallel lines (- - -) are also shown.

May be photocopied for student use.

WRITTEN
TEST

LEGAL LAND DESCRIPTIONS

C-2

Name ______________________ Date _________ Score ____

OBJECTIVE 1

State reasons for using legal land descriptions. Write four reasons for using legal land descriptions in the blanks provided.

1. ____
2. ____
3. ____
4. ____

OBJECTIVE 2

Match line divisions used in the United States Public Land Survey (USPLS) to their descriptions. Write the correct letters in the blanks.

A. base line
B. correction lines
C. guide meridians
D. initial point
E. prime meridian
F. prime parallel
G. range lines
H. section
I. principal meridian
J. standard meridians
K. standard parallels
L. township lines

_____ 1. The longitude; a line running true north and south, that intersects the base line at the initial point

_____ 2. Formed by the intersection of the base line and the principal meridian

_____ 3. North-south lines at six-mile intervals parallel to the principal meridian

_____ 4. East-west lines at six-mile intervals parallel to the base line

_____ 5. True meridians extended north from the base line or from standard parallels at intervals of 24 mile east and west from the principal meridian

May be photocopied for student use.

____ 6. Lines surveyed every 24 miles north and south of the base line and parallel with it

____ 7. The latitude; a principal parallel line running true east and west; intersects the principal meridians at the initial point

OBJECTIVE 3

Choose the correct word or phrase to complete statements about subdivisions. Write the correct letters in the blanks.

____ 1. Lot numbers on river lots usually run ____________.

A. upstream to the section line, then downstream
B. upstream throughout the section
C. downstream to the section line, then upstream
D. downstream throughout the section

____ 2. Townships are divided into ____________.

A. ranges
B. sections
C. quadrants
D. lots

____ 3. The correct township description is ____________.

A. T1N, R2W
B. R3E, T4W
C. T2S
D. R4W

____ 4. In counties bordering oceans, lakes, and streams, you can expect to have ____________.

A. correction lines
B. irregular subdivisions
C. broken meridians
D. fractional sections

____ 5. A section is approximately ____________.

A. 10 chains
B. 1 square mile
C. 4 square miles
D. 320 acres

May be photocopied for student use.

____ 6. Quadrangles are divided into ____________.

A. townships
B. ranges
C. sections
D. subdivisions

____ 7. The #1 section in a township is always in the ____________.

A. northwest corner
B. northeast corner
C. southwest corner
D. southeast corner

____ 8. The length of each side of a township, except the north where the distance is slightly smaller, is ____________.

A. 1 mile
B. 6 miles
C. 24 miles
D. 36 miles

____ 9. The section subdivision that is INCORRECT IS ____________.

A. 5 acres
B. 10 acres
C. 40 acres
D. 160 acres

____ 10. Quadrangles are approximately ____________.

A. 320 square-mile divisions
B. 40 square-mile divisions
C. 24 square-mile divisions
D. 12 square-mile divisions

May be photocopied for student use. 384

_____ 11. Correction lots or fractional sections are fractional lots of _____________.

A. one-half acres
B. 5 acres
C. 10 acres
D. 40 acres

_____ 12. From the principal meridian, ranges are numbered consecutively _____________.

A. north and south
B. east and west
C. northeast and southwest
D. southeast and northwest

OBJECTIVE 4

Choose the correct word or phrase about reading USPLS system subdivision sections. Write the correct letters in the blanks.

_____ 1. It is easier to read legal descriptions from __________________.

A. left to right
B. right to left
C. top to bottom
D. bottom to top

_____ 2. The symbols **and, &,** and **; (semicolon)** mean __________________.

A. single tracts
B. larger divisions
C. smaller divisions
D. separate tracts

_____ 3. A full legal description starts with the ________________ divisions.

A. most valuable
B. smallest
C. largest
D. middle

May be photocopied for student use.

____ 4. Two letters alone mean ____________ section.

A. 1/4
B. 1/2
C. 1
D. 1/3

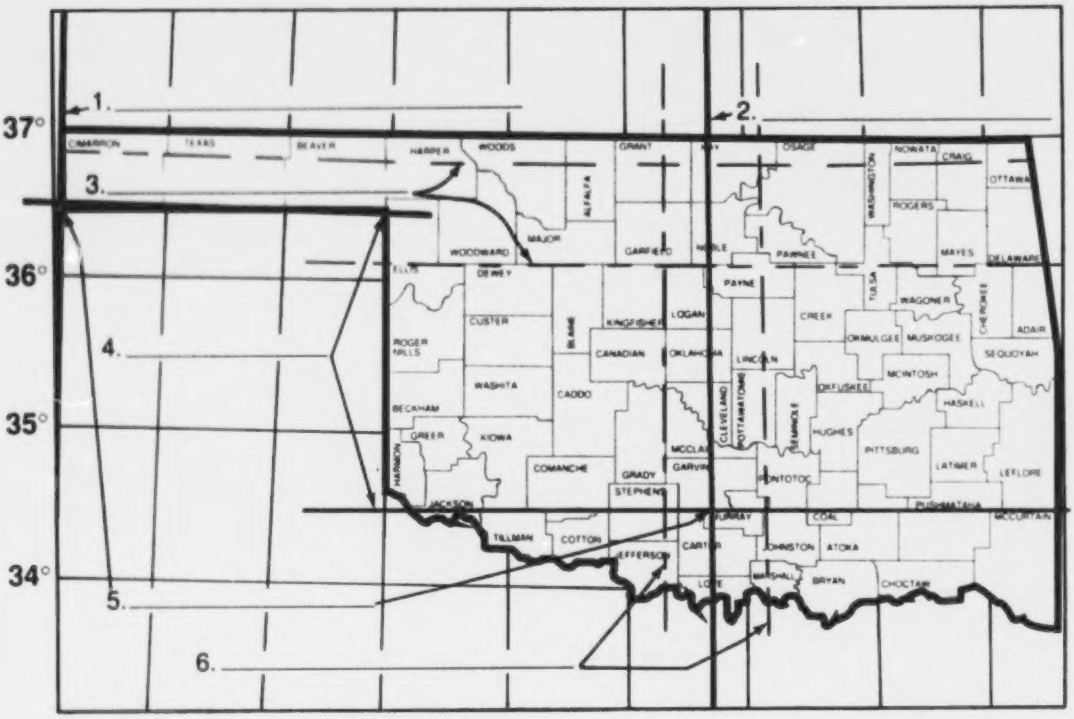
____ 5. 80 acres make ____________ section.

A. 1/2 of 1/4
B. 1/4
C. 1
D. 1/2

____ 6. A single letter means ____________ section.

A. 1/4
B. 1/2
C. 1
D. 1/3

OBJECTIVE 5 **Identify principal meridians, base lines, and initial points.** Write the correct name in the blank provided.



1. ____
2. ____
3. ____
4. ____
5. ____
6. ____
37°
36°
35°
34°
CIMARRON
TEXAS
BEAVER
HARPER
WOODS
ALFALFA
GRANT
KAY
OSAGE
WASHINGTON
NOWATA
CRAIG
OTTAWA
ROGERS
MAYES
DELAWARE
WOODWARD
MAJOR
GARFIELD
NOBLE
PAWNEE
ELLIS
DEWEY
PAYNE
TULSA
WAGONER
CHEROKEE
ADAIR
CUSTER
BLAINE
KINGFISHER
LOGAN
CREEK
OKMULGEE
MUSKOGEE
SEQUOYAH
ROGER MILLS
CANADIAN
OKLAHOMA
LINCOLN
WASHITA
CADDO
CLEVELAND
POTTAWATOMIE
OKFUSKEE
MCINTOSH
HASKELL
BECKHAM
SEMINOLE
HUGHES
GREER
KIOWA
MCCLAIN
PITTSBURG
HARMON
COMANCHE
GRADY
GARVIN
PONTOTOC
LATIMER
LEFLORE
STEPHENS
JACKSON
PUSHMATAHA
MURRAY
COAL
MCCURTAIN
TILLMAN
COTTON
JEFFERSON
CARTER
JOHNSTON
ATOKA
LOVE
MARSHALL
BRYAN
CHOCTAW

OBJECTIVE 6 **Evaluated on Assignment Sheet 1.**

OBJECTIVE 7 **Evaluated on Assignment Sheet 2.**

387

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LAP SHEET

GROWTH AND REPRODUCTION

D-1

Name ______________________________

Check the blank as you complete each step.

1. Take ____ the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

2. Read ____ the introduction, unit objective, and specific objectives.

3. Do ____ the focus assignments.

4. Stop ____ and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.

5. Study ____ the Information Sheet, objective 1.

Optional: Experiment ____ with sprouting seeds in a jar then mounting the resulting specimen as examples of each stage in the life cycle of plants.

Optional: Create ____ a chart showing the different lengths of time various plants spend in each stage of their life.

6. Study ____ the Information Sheet, objective 2.

Optional: Write ____ a short report on how plant transpiration would vary over the course of a week based on a week-long weather report.

Optional: Draw ____ a graph showing changes in transpiration over a two month period of time, based on predictions in the Farmer's Almanac.

May be photocopied for student use.

7. **Study** ____ the Information Sheet, objective 3.

Optional: Develop ____ a creative way to illustrate the formula for respiration.

8. **Study** ____ the Information Sheet, objective 4.

Optional: Write ____ a brief report explaining the process of respiration.

Optional: Make ____ some type of chart, graph, picture, or model that illustrates how respiration works.

9. **Study** ____ the Information Sheet, objective 5.

Optional: Write ____ a brief report on how respiration and photosynthesis relate to each other.

Optional: Interview ____ a science teacher or some other "expert" about photosynthesis.

10. **Study** ____ the Information Sheet, objective 6.

Optional: Write ____ an in-depth report on one agronomic classification of plants.

11. **Study** ____ the Information Sheet, objective 7.

Optional: Dissect ____ and label a legume, grain, or tuber.

12. **Study** ____ the Information Sheet, objective 8.

Optional: Write ____ a short report on which method of crop improvement you would personally be most interested in trying and why.

May be photocopied for student use.

13. **Study** ____ the Information Sheet, objective 9.

Optional: Research ____ plants that have been recently changed or developed through genetic engineering.

Optional: Write ____ a brief report on what you learned in your research.

14. **Study** ____ the Information Sheet, objective 10.

Optional: Bring ____ an actual sample, picture, or report of a plant that has been cloned to class.

15. **Do** ____ Assignment Sheet 1.

16. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

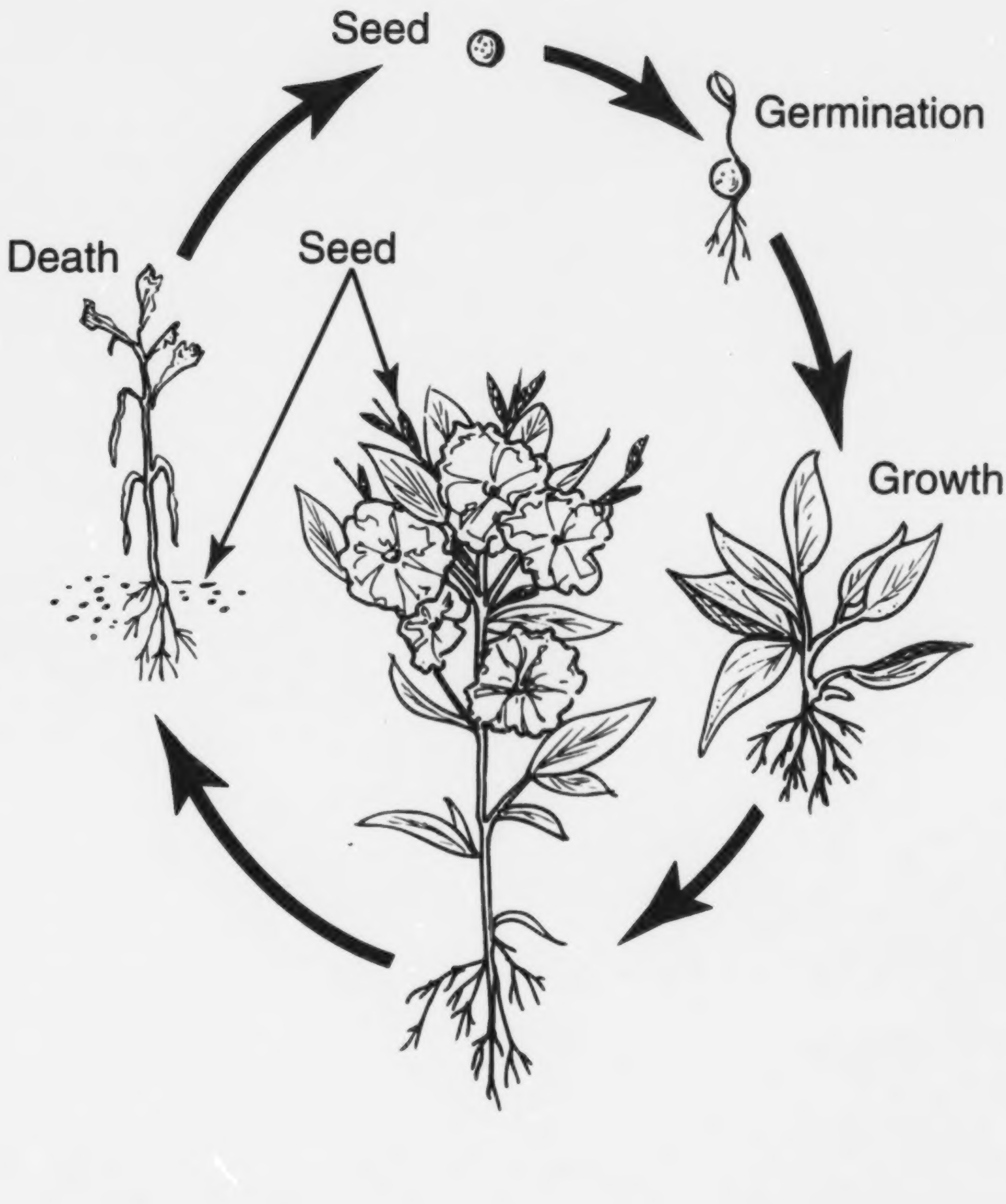
17. **Do** ____ Assignment Sheet 2.

18. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

19. **Take** ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

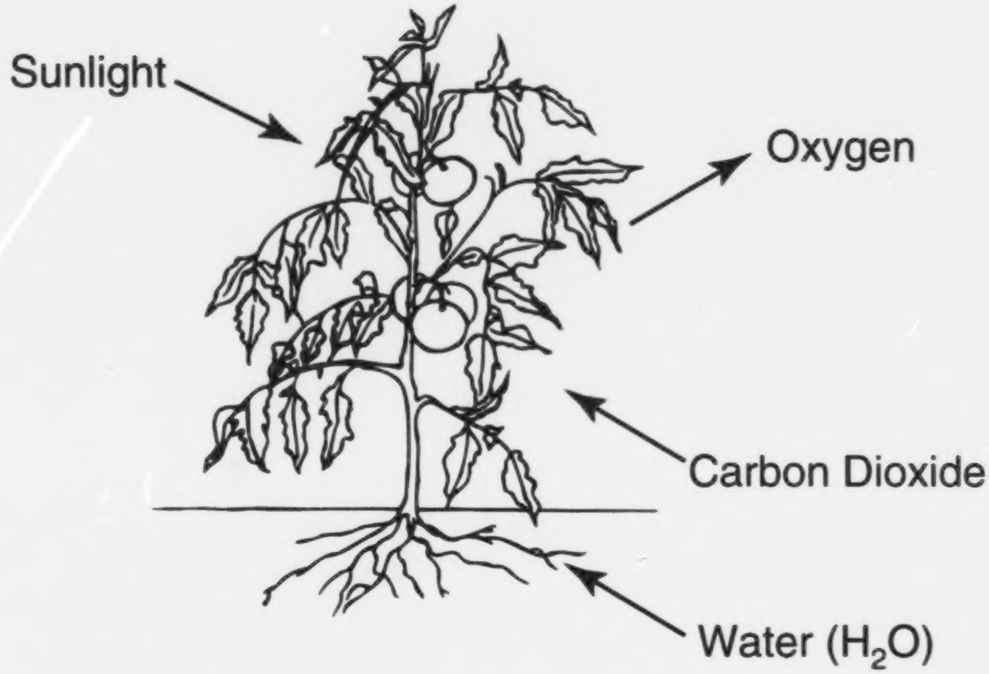
May be photocopied for student use.

Life Cycle of Plants


Seed
Germination
Growth
Death
Seed

May be photocopied for student use. 391

Photosynthesis


Sunlight
Oxygen
Carbon Dioxide
Water (H_2O)

Photosynthesis (manufacturer of food)

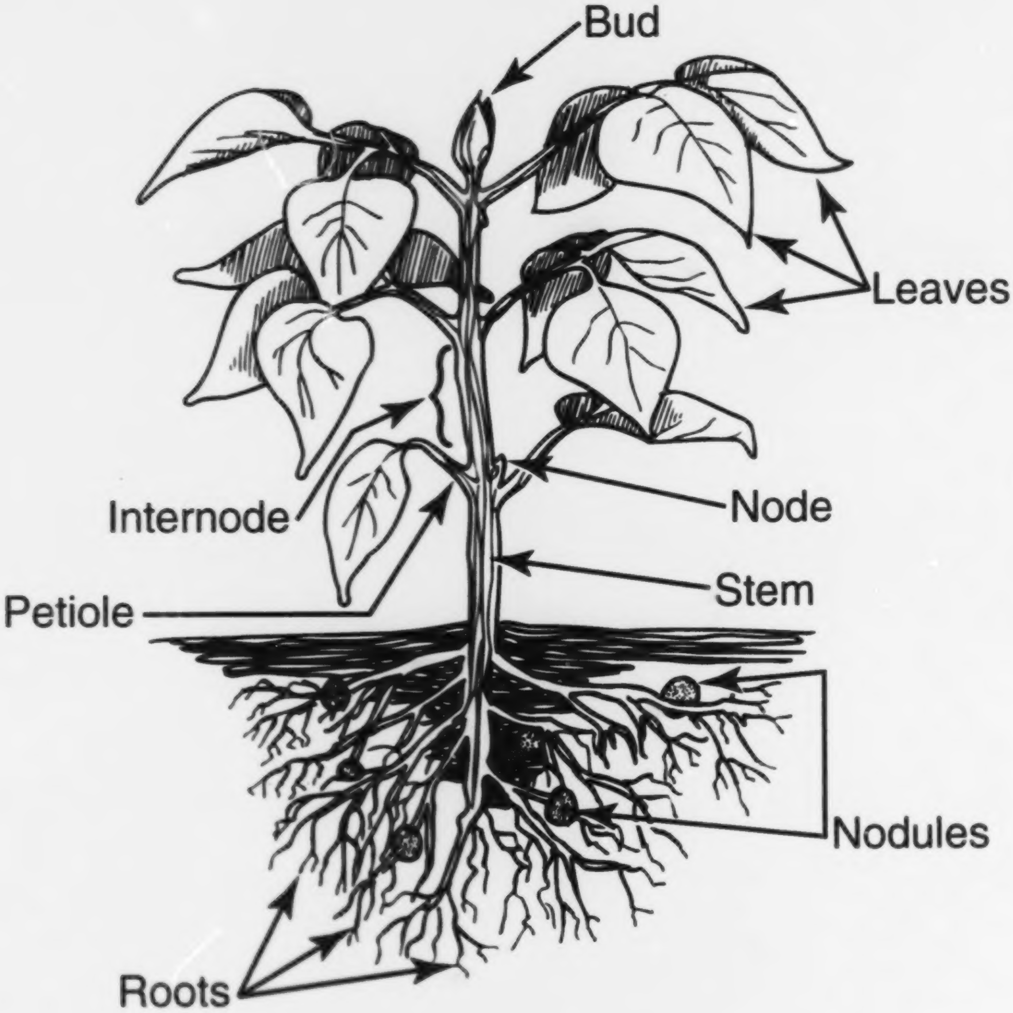
$$6C0_2 + 12H_20 \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}0_6 + 60_2 + 6H_20$$

Respiration (reverse process)

$$C_6H_{12}0_6 + 60_2 \longrightarrow 6C0_2 + 6H_20 + \text{energy}$$

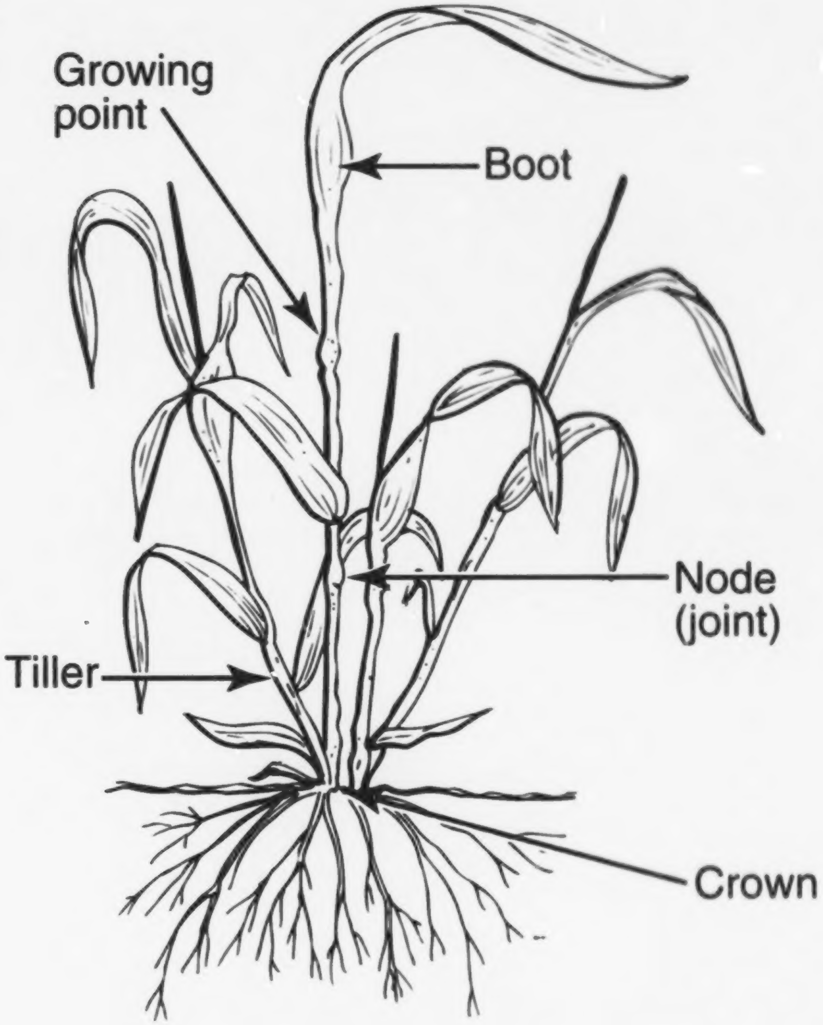
May be photocopied for student use.

Parts of a Legume


Bud
Leaves
Internode
Node
Petiole
Stem
Nodules
Roots

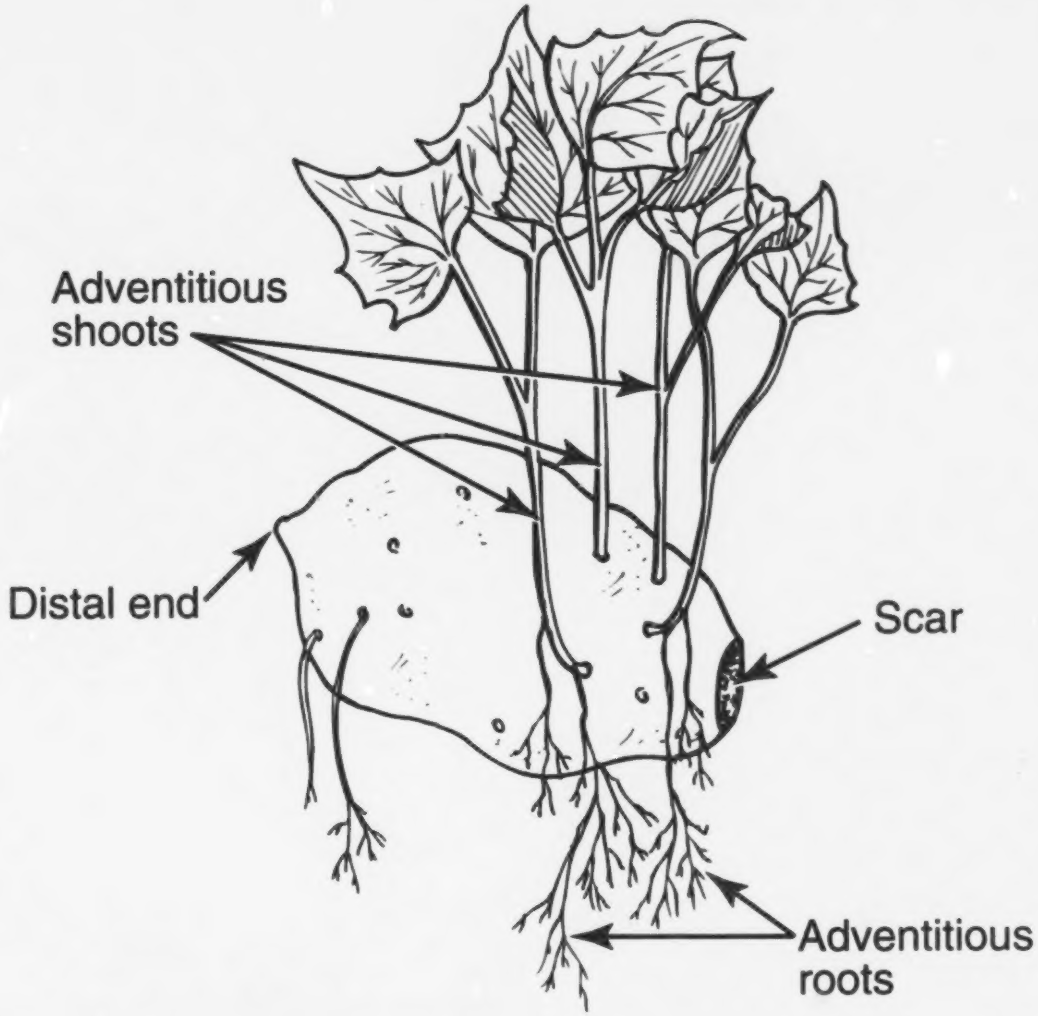
May be photocopied for student use.

Parts of a Grain


Growing point
Boot
Node (joint)
Tiller
Crown

May be photocopied for student use.

Parts of a Tuber


Adventitious shoots
Distal end
Scar
Adventitious roots

May be photocopied for student use.

GROWTH AND REPRODUCTION

D-1

Name ______________________________ Date _________ Score ___

OBJECTIVE 1

Arrange in order the stages in the life cycle of plants. Write the letter of the answer in the blank.

A. maturation
B. active growth
C. germination
D. reproduction
E. seedling

_____ 1. First stage in life cycle of plants.

_____ 2. Second stage in life cycle of plants.

_____ 3. Third stage in life cycle of plants.

_____ 4. Fourth stage in life cycle of plants.

_____ 5. Fifth stage in life cycle of plants.

OBJECTIVE 2

Explain transpiration. Write a brief answer to each of the following questions.

1. What is the definition for transpiration?

____

____

____

2. Name three things that influence transpiration.

____

____

____

May be photocopied for student use.

3. Explain how a change in humidity affects transpiration.

4. What happens when temperatures go up?

5. On what part of the plant does transpiration primarily take place?

OBJECTIVE 3

State the formula for respiration. Write the formula in the space provided below.

May be photocopied for student use.

OBJECTIVE 4

Explain the process of respiration. Write your answer in the space provided.

____

____

____

____

____

____

OBJECTIVE 5

State the formula for photosynthesis. Write the formula in the space provided below.

OBJECTIVE 6

Discuss types of plants based upon their agronomic classification. Following each classification listed below, write a brief explanation of how that crop is used, then list at least two of the plants included in that classification.

1. Oil-Seed Crops

   A. Are used in the following manner:

   ____

   ____

   ____

May be photocopied for student use.

B. Oil-seed crops include:

2. Cereals or Grain Crops

A. Are used in the following manner (be sure to list uses for both cereals and grains):

B. Cereals include:

3. Special Crops

A. Are used in the following manner:

B. Special crops include:

4. Root and Tuber Crops

A. Are used in the following manner:

B. Root and tuber crops include:

May be photocopied for student use.

5. Sugar Crops

A. Are used in the following manner:

____

____

____

B. Sugar crops include:

____

6. Forage and Pasture Crops

A. Are used in the following manner:

____

____

____

B. Forage and pasture crops include:

____

____

7. Fiber Crops

A. Are used in the following manner:

____

____

____

B. Fiber crops include:

____

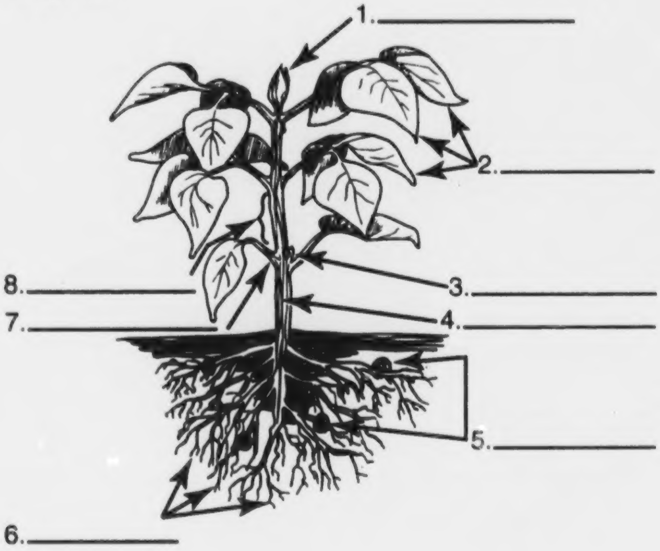
____

May be photocopied for student use.

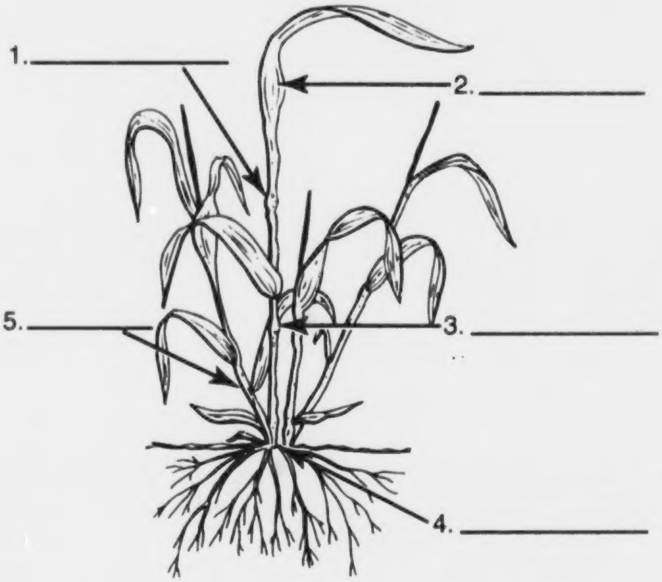
OBJECTIVE 7

Label parts of a legume, grain, and tuber. Label the parts of the legume, grain, and tuber shown below.

Parts of a legume:

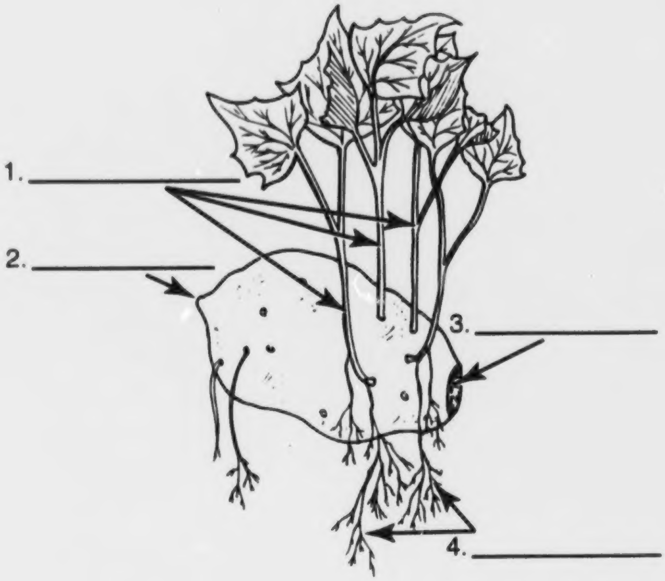


Parts of a grain:



May be photocopied for student use.

Parts of a tuber:



May be photocopied for student use.

OBJECTIVE 8

Describe methods of crop improvement. Write a brief answer for each question.

1. What is the advantage of introducing crop varieties that have been developed elsewhere?

2. Finish this statement: "Introducing varieties developed elsewhere normally presents few problems in terms of adaptation, if ...

3. Why is the selection method limited in scope?

4. What is mass selection?

5. How are individual plant selections made?

May be photocopied for student use.

6. What does hybridization allow breeders to do?

7. Why is hybridization often used to cross varieties?

OBJECTIVE 9

Define genetic engineering. Write your definition below.

OBJECTIVE 10

Define cloning. Write your definition below.

OBJECTIVE 11

Describe uses of defoliants and growth inhibitors. Write your answers in the blanks.

1. List three reasons why defoliants are used when cotton is machine harvested.

2. List three uses of growth inhibitors.

OBJECTIVE 12

Evaluated on Assignment Sheet 1.

OBJECTIVE 13

Evaluated on Assignment Sheet 2.

May be photocopied for student use.

LAP
SHEET

SEEDS AND PLANTS: SELECTION, PREPARATION, AND PLANTING

D-2

Name ______________________________

Check the blank as you complete each step.

1. **Take** ____ the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

2. **Read** ____ the introduction, unit objective, and specific objectives.

3. **Do** ____ the focus assignments.

4. **Stop** ____ and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.

5. **Study** ____ the Information Sheet, objective 1.

Optional: Talk ____ to a county extension agent about the pitfalls of using less than high-quality seed.

Optional: Write ____ a brief report on what could happen if someone bought seed that didn't meet one of the criterion for selecting high-quality seed.

6. **Study** ____ the Information Sheet, objective 2.

Optional: Visit ____ farmland that has been tilled.

Optional: Report ____ on the benefits of tillage.

May be photocopied for student use.

7. **Study** ____ the Information Sheet, objective 3.

8. **Read** ____ *Evaluation of Lo-Till Demonstrations*, OSU Current Report No. 2900.

Optional: Write ____ a brief report on OSU Current Report No. 2900.

9. **Study** ____ the Information Sheet, objective 4.

Optional: Visit ____ a feed store.

Optional: Identify ____ five different types of seed.

10. **Study** ____ the Information Sheet, objective 5.

Optional: Identify ____ the types of leaves and roots plant samples have.

Optional: Write ____ a list of the various characteristics that plants can have.

11. **Study** ____ the Information Sheet, objective 6.

Optional: Write ____ a report on what would comprise the ideal site for three crops not listed on the information sheet for objective 6.

Optional: Write ____ a list of types of crops that would grow well in imaginary sites.

12. **Study** ____ the Information Sheet, objective 7.

Optional: Write ____ a short report on factors that affect seeding rates.

13. **Study** ____ the Information Sheet, objective 8.

Optional: Develop ____ a poster that illustrates the different methods of planting.

May be photocopied for student use.

Optional: Mold ____ dirt in small boxes into the shape of a field after it has undergone each of the planting methods.

14. **Do** ____ Assignment Sheet 1.

15. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

16. **Do** ____ Assignment Sheet 2.

17. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

18. **Do** ____ Assignment Sheet 3.

19. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

20. **Do** ____ Assignment Sheet 4.

21. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

22. **Ask** ____ your instructor to demonstrate the guidelines and procedures in Job Sheet 1. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

23. **Practice** ____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

24. **Stop** ____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

May be photocopied for student use.

25. **Ask** ____ your instructor to demonstrate the guidelines and procedures in Job Sheet 2. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

26. **Practice** ____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

27. **Stop** ____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

28. **Ask** ____ your instructor to demonstrate the guidelines and procedures in Job Sheet 3. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

29. **Practice** ____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

30. **Stop** ____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

31. **Ask** ____ your instructor to demonstrate the guidelines and procedures in Job Sheet 4. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

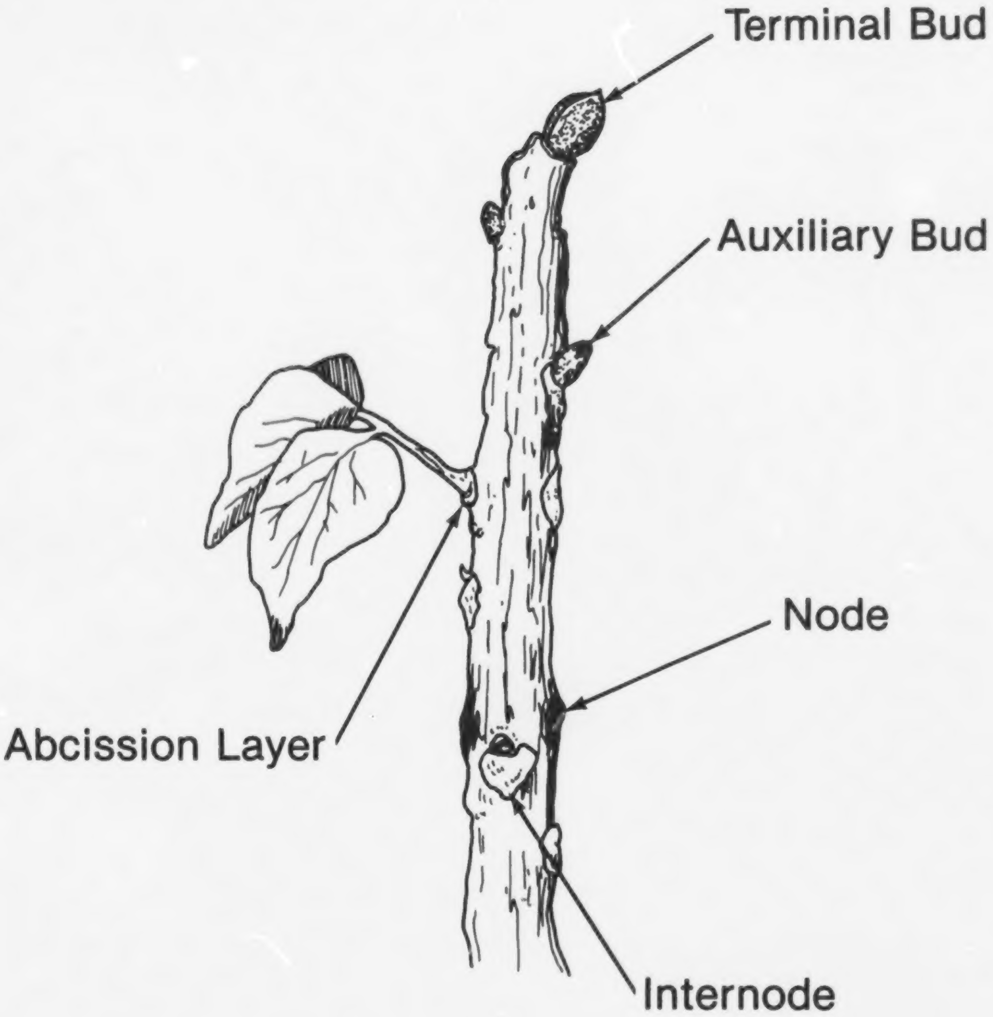
32. **Practice** ____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

33. **Stop** ____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

34. **Take** ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

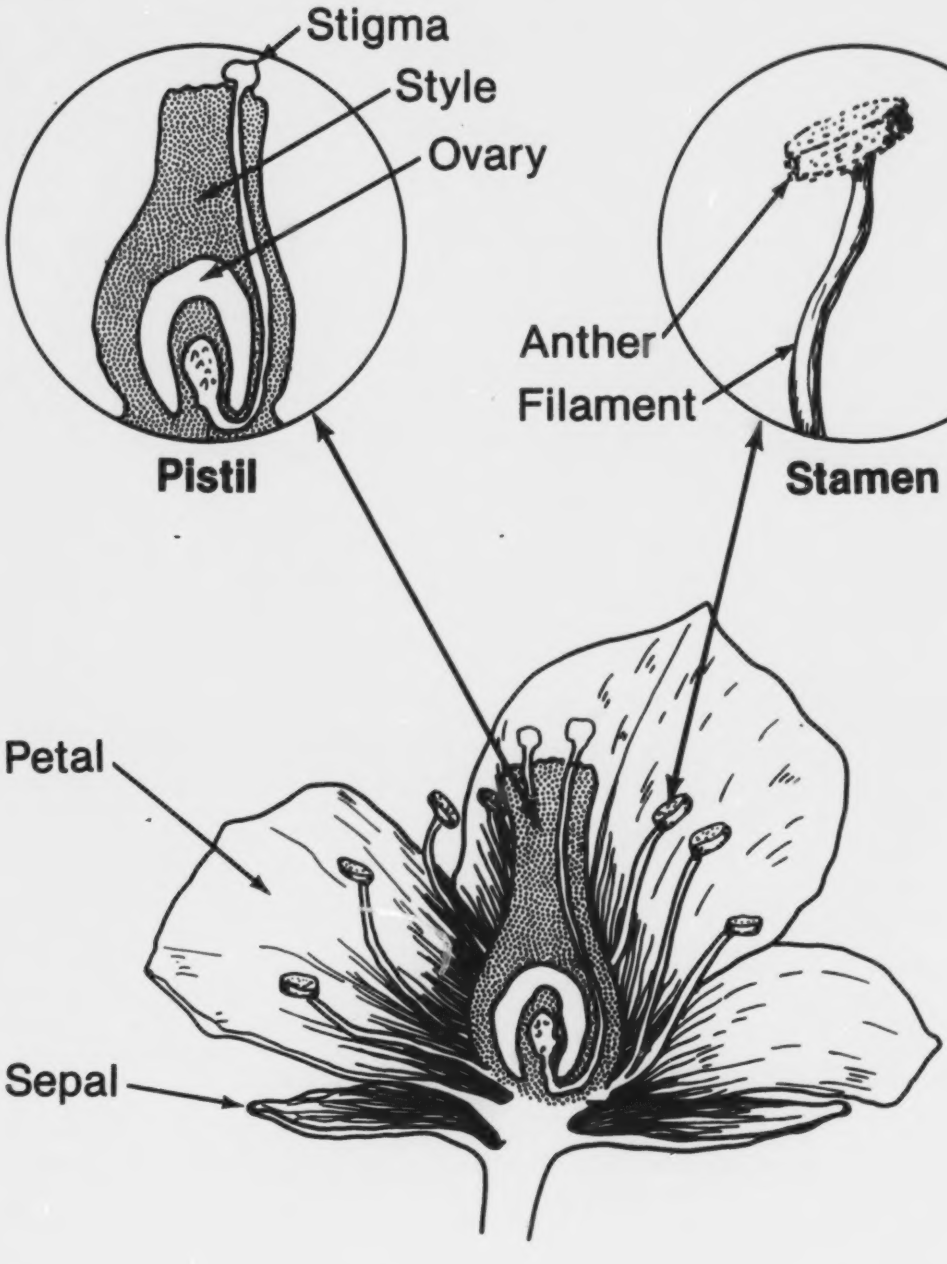
May be photocopied for student use.

Parts of a Stem


Terminal Bud
Auxiliary Bud
Node
Abcission Layer
Internode

May be photocopied for student use.

Parts of a Flower


Stigma
Style
Ovary
Pistil
Anther
Filament
Stamen
Petal
Sepal

May be photocopied for student use.

WRITTEN TEST

SEEDS AND PLANTS: SELECTION, PREPARATION, AND PLANTING

D-2

Name ______________________ Date _________ Score ___

OBJECTIVE 1

Select from a list guidelines for selecting high-quality seed. Place check marks beside the actual guidelines.

_____ 1. Purchased in Oklahoma

_____ 2. Purchased from a reliable dealer

_____ 3. Reviewed by the State Legislature

_____ 4. Approved by the Feed and Seed Board

_____ 5. Certified by the state certified seed program

_____ 6. Recommended by the certified seed program as a variety that can adapt to your area

_____ 7. Recommended by Feed and Seed Board as seed that will produce attractive plants

_____ 8. Has an average level of germination

_____ 9. Has a high percentage of germination

_____ 10. Has plenty of inert matter

_____ 11. Has a healthy sprinkling of other crop seed

_____ 12. Has irradiated weed seed

_____ 13. Has a high percentage of purity

_____ 14. Is svelte and tanned

_____ 15. Is plump and full-sized

_____ 16. Has little or no damage

_____ 17. Is close to the cultivar you desire

_____ 18. Is the desired cultivar

May be photocopied for student use.

OBJECTIVE 2

State reasons for tillage. Write five reasons in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

OBJECTIVE 3

Explain the purpose of various tillage systems. Write a brief answer to each question.

1. What are conservation tillage systems designed to do?

____

____

____

2. What is the purpose of clean tillage?

____

____

____

3. What role does conventional tillage play?

____

____

____

4. What is the purpose of a no-till system?

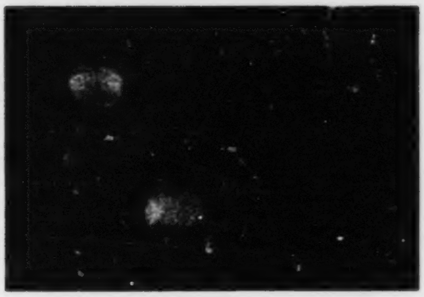
____

____

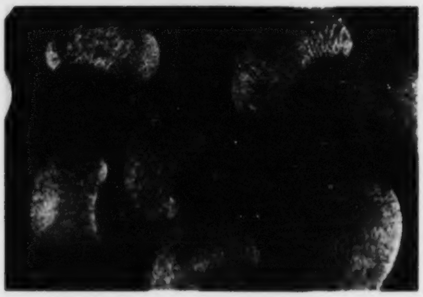
____

May be photocopied for student use.

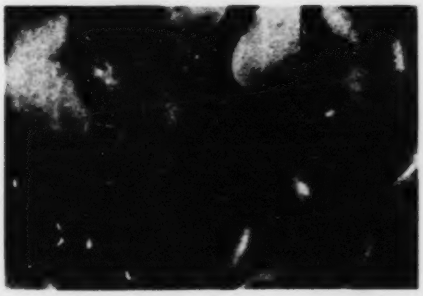
OBJECTIVE 4 **Identify common crop seeds**. Look at the photographs below. Correctly label each type of seed.



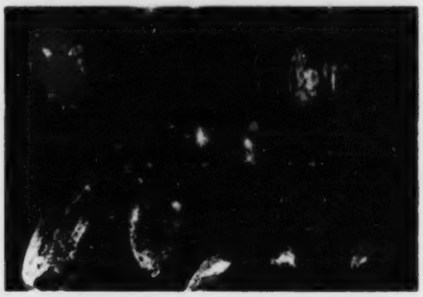
1. ____________



2. ____________

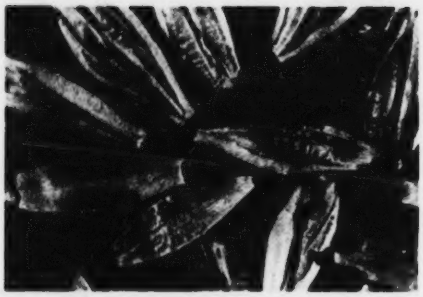


3. ____________

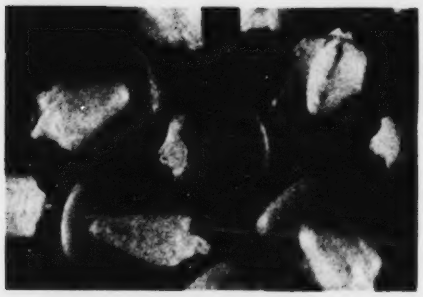


4. ____________

May be photocopied for student use. 414

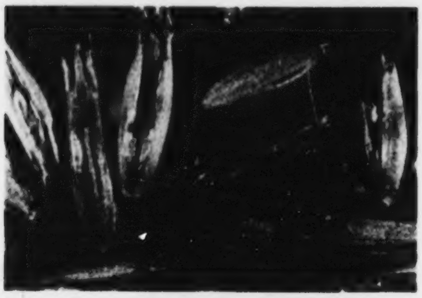


5. ______________



6. ______________

7. ______________

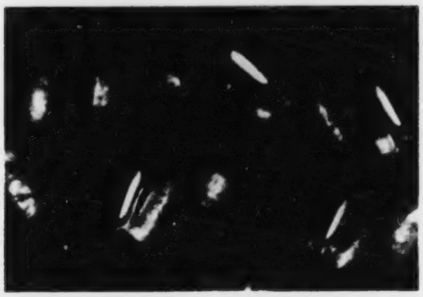


8. ______________

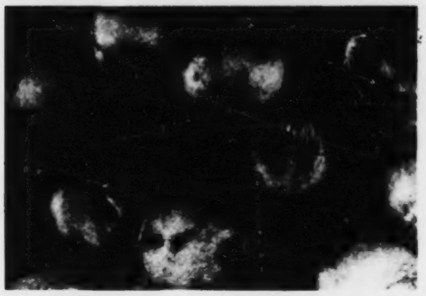
May be photocopied for student use.

9. ______________

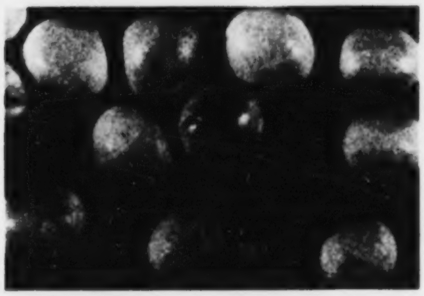
10. ______________



11. ______________



12. ______________



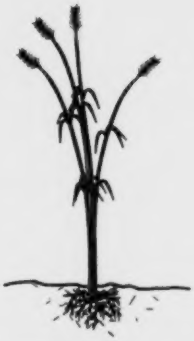
13. ______________

May be photocopied for student use.

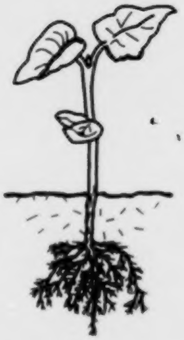
OBJECTIVE 5

Identify characteristics of common plants. Based on the drawings below, write a brief answer to each question.

Wheat Plant



Soybean Plant



1. What type of root does the wheat plant have?

____

2. Indicate the type of leaves the wheat plants has, be as specific as possible.

____

3. What type of root does the soybean plant have?

____

4. Name the type of leaves on the soybean plant, be as specific as possible.

____

May be photocopied for student use.

OBJECTIVE 6

Choose an appropriate site for a specified crop. Beside each number, write the letter of the crop that would be most suited to the type of site listed.

A. Cotton
B. Wheat
C. Rye
D. Soybeans
E. Oats

_____ 1. A field that has been planted with wheat every year for the past ten years

_____ 2. A field with clay loam that has lain fallow for two years

_____ 3. A well-drained field in a warm climate with adequate water during the growing season of 200 or more days

_____ 4. A fertile, well-drained field that averages 23 inches of rain during every growing season

_____ 5. A field that is available in the spring in an area that averages 60 degrees year-round with steady, but light, rainfall

OBJECTIVE 7

List factors affecting seeding rates. Write six factors in the blanks provided.

1. ________________________________
2. ________________________________
3. ________________________________
4. ________________________________
5. ________________________________
6. ________________________________

May be photocopied for student use.

OBJECTIVE 8

Describe methods of planting. Write a brief answer to each question.

1. Where would you plant in beds?

2. What does this planting method accomplish?

3. In what areas would you plant in furrows?

4. What does this method accomplish?

5. Name a benefit involved in using this method.

6. Where is planting on dry land used?

May be photocopied for student use.

OBJECTIVE 9	**Evaluated on Assignment Sheet 1.**
OBJECTIVE 10	**Evaluated on Assignment Sheet 2.**
OBJECTIVE 11	**Evaluated on Assignment Sheet 3.**
OBJECTIVE 12	**Evaluated on Assignment Sheet 4.**
OBJECTIVE 13	**Evaluated on Job Sheet 1.**
OBJECTIVE 14	**Evaluated on Job Sheet 2.**
OBJECTIVE 15	**Evaluated on Job Sheet 3.**
OBJECTIVE 16	**Evaluated on Job Sheet 4.**

May be photocopied for student use.

HANDOUT 1

COMMONLY RECOGNIZED CLASSES OF SEED

Each state has its own certifying agency for seeds. These are usually called seed or crop improvement associations, and they are usually designated by state law as the official seed-certifying agency for that state. These associations closely monitor the production and distribution of the seed they certify. Any seed that is certified by a seed-certifying agency must meet rigid inspection and handling requirements to assure consistency.

Seed-certifying agencies recognize four classes, or types, of seed. They are as follows:

BREEDER'S SEED - seed that is produced under the direct supervision and control of a plant breeder; this type of seed is not available to the general public; breeder's seed is normally comprised of a limited amount of seed used to maintain a genetically pure source of a strain or cultivar.

☑ **NOTE:** After a sufficient quantity of breeder's seed is reproduced, it is no longer considered a breeder seed but rather a foundation seed.

FOUNDATION SEED - the "offspring" of breeder's seed that has been carefully produced to meet designated standards; after seed meets the requirements for classification as a foundation seed it is labeled with a white tag issued by the certifying agency.

REGISTERED SEED - is the "offspring" of foundation seed that has been carefully produced and handled to maintain genetic identity and purity; seed that meets the requirements for registered seed is labeled with a purple tag.

CERTIFIED SEED - is the most commonly available class of seed; it is developed from carefully produced foundation and registered seed; certified seed is labeled with a blue tag after it is determined to have met all designated standards of genetic identity and purity.

May be photocopied for student use.

PLANT CLASSIFICATIONS BASED ON LIFE-CYCLE PATTERNS

ANNUAL - Germinated, grows, reproduces, matures, and dies within one year

EXAMPLES: Corn, oats, barley, spring wheat, rice, soybeans, cocklebur, common broomweed, pigweed

WINTER ANNUAL - Germinated in the fall, lies dormant through the winter, then matures, sets seed, and dies in the spring or early summer

EXAMPLES: Winter wheat, winter barley, winter oats, winter rye, cheat, mustards, buckwheat

BIENNIAL - Requires two growing seasons to complete its life cycle

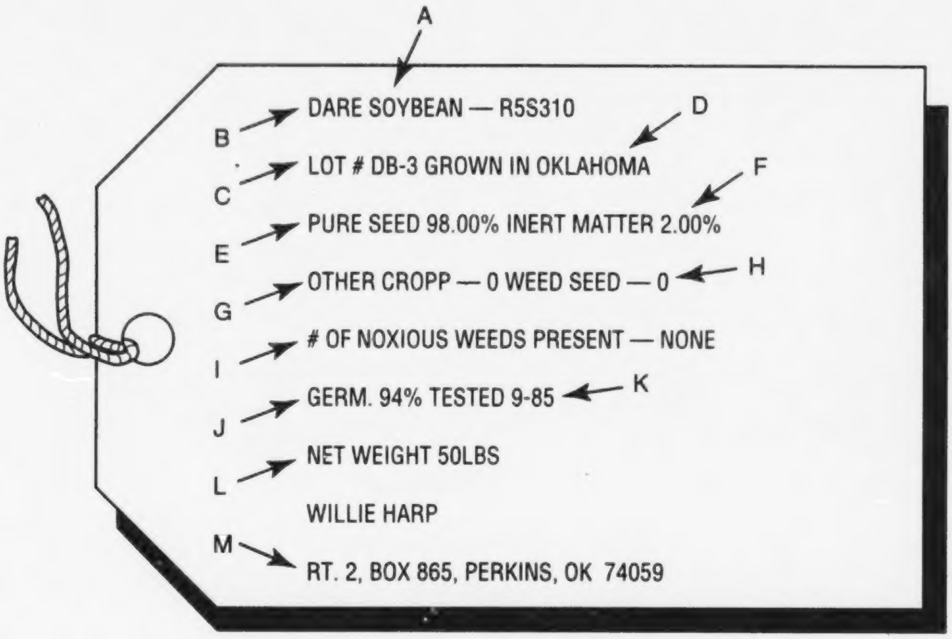
EXAMPLES: Sugar beets, sweet clover

PERENNIAL - Survives more than two years (frequently indefinitely), usually producing seeds each year, becomes dormant before starting new vegetative growth, and repeating cycle

EXAMPLES: Alfalfa, Kentucky bluegrass, Bermudagrass, Johnsongrass, orchard grass, smooth bromegrass, most native pasture grasses, bindweed, western ragweed, nut sedge

May be photocopied for student use.

INTERPRETATION OF INFORMATION ON COMMERCIAL SEED TAGS


A
B
DARE SOYBEAN — R5S310
D
C
LOT # DB-3 GROWN IN OKLAHOMA
F
E
PURE SEED 98.00% INERT MATTER 2.00%
G
OTHER CROPP — 0 WEED SEED — 0
H
I
# OF NOXIOUS WEEDS PRESENT — NONE
J
GERM. 94% TESTED 9-85
K
L
NET WEIGHT 50LBS
WILLIE HARP
M
RT. 2, BOX 865, PERKINS, OK 74059

A. Crop name

B. Variety (cultivar)

C. Grower's lot number

D. Origin

E. Pure seed percentage

F. Inert matter percentage

G. Other crop percentage

H. Weed seed percentage

I. Name and number of noxious weeds per pound

J. Germination percentage

K. Germination test date

☑ **NOTE:** If the germination test date is nine months old, then the sample must be tested again and retagged.

L. Weight of contents

M. Name and address of shipper, seller, or person who labeled the seeds

May be photocopied for student use.

ROW LENGTH PER ACRE

	LENGTH OF ROW EQUALS:	
ROW SPACING	1/50 ACRE	1/1000 ACRE
28 in.	373 ft.	18 ft. 8 in.
30 in.	349 ft.	17 ft. 5 in.
32 in.	327 ft.	16 ft. 4 in.
34 in.	308 ft.	15 ft. 4 in.
36 in.	290 ft.	14 ft. 6 in.
38 in.	275 ft.	13 ft. 9 in.
40 in.	261 ft.	13 ft. 2 in.

SECOND METHOD FACTORS

ROW SPACING	MULTIPLYING FACTOR
40 in.	4.36
38 in.	4.59
36 in.	4.84
30 in.	5.81321

May be photocopied for student use.

DRILLING DISTANCE FOR 1/10 ACRE

Drilling Width (Feet)	Distance for 1/10 Acre (Feet)
7 ft.	311 ft.
8 ft.	272 ft.
9 ft.	242 ft.
10 ft.	218 ft.
11 ft.	198 ft.
12 ft.	182 ft.
13 ft.	168 ft.
14 ft.	156 ft.

May be photocopied for student use.

LAP SHEET

COMMON PESTS

D-3

Name ______________________________

Check the blank as you complete each step.

1. **Take** ____ the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

2. **Read** ____ the introduction, unit objective, and specific objectives.

3. **Do** ____ the focus assignments.

4. **Stop** ____ and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.

5. **Study** ____ the Information Sheet, objectives 1 and 2.

Optional: Write ____ a list of examples of what you consider pests.

6. **Study** ____ the Information Sheet, objective 3.

Optional: Write ____ a short paper on a specific insect.

7. **Study** ____ the Information Sheet, objective 4.

Optional: Observe ____ insect damage on plants.

Optional: Observe ____ examples of chewing and sucking insects. Look at the insects under a microscope.

May be photocopied for student use.

8. Study ____ the Information Sheet, objective 5.

Optional: Read ____ the following Oklahoma State University publications:

- ☐ F-7150 *Alfalfa Forage Insect Control*
- ☐ F-7156 *Field Key to Larvae in Soybeans*
- ☐ F-7158 *Field Key to Larvae in Peanuts*
- ☐ F-7159 *Field Key to Larvae in Alfalfa*
- ☐ F-7160 *Field Key to Larvae in Corn*
- ☐ F-7161 *Field Key to Larvae in Cotton*
- ☐ F-7162 *Cotton Insect Control in Oklahoma 1988-89*
- ☐ F-7167 *Soybean Insect Survey and Control*
- ☐ F-7168 *Plant Galls Caused by Insects*
- ☐ F-7170 *Control of Sorghum Insects*
- ☐ F-7174 *Peanut Insect Control in Oklahoma*
- ☐ F-7176 *Insects on Small Grains and Their Control*
- ☐ CR-7177 *Scouting for the Alfalfa Weevil in Oklahoma*
- ☐ F-7180 *Stored Grain Insect Control in Oklahoma*
- ☐ F-7183 *Russian Wheat Aphid in Oklahoma*
- ☐ F-7184 *Alfalfa Aphids in Oklahoma*

Optional: Interview ____ a local county extension agent or other crop specialist about insects common to crops.

9. Do ____ Assignment Sheet 1.

10. Stop ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

11. Study ____ the Information Sheet, objectives 7 and 8.

Optional: Observe ____ common weeds in your area.

12. Study ____ the Information Sheet, objective 9.

Optional: Observe ____ examples of bird and wildlife damage to plants.

Optional: Read ____ OSU Fact Sheet F-9001, *Controlling Pocket Gophers*.

May be photocopied for student use.

13. Study ____ the Information Sheet, objectives 10-11.

Optional: Observe ____ plants that show indications of diseases. Write down the symptoms of the plants.

Optional: Read ____ OSU Fact Sheet F-7612, *Plant Disease Diagnostic Service.*

14. Do ____ Assignment Sheet 2.

Optional: Read ____ the following Oklahoma State University publications:

- ☐ F-7609 *Leaf Rust and Stem Rust of Wheat*
- ☐ F-7622 *Wheat Root Rots*
- ☐ F-7629 *Wheat Soil-Borne Mosaic Virus Disease*
- ☐ F-7631 *Bunt and Loose Smut Disease of Wheat*
- ☐ F-7633 *Powdery Mildew of Wheat*
- ☐ F-7636 *Wheat Streak Mosaic Virus Disease*
- ☐ F-7648 *Stem Nematodes in Alfalfa*
- ☐ F-7649 *Stalk Rot of Sorghum*
- ☐ F-7650 *Fusarium Wilt-Nematode Complex of Cotton*
- ☐ F-7654 *Seedling Disease in Cotton*
- ☐ F-7655 *Foliar Diseases of Peanuts*
- ☐ CR-7656 *Southern Blight Disease Control Demonstrations*

Optional: Interview ____ a local county extension agent or other crop specialist about diseases common to crops.

15. Stop ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

16. Take ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

May be photocopied for student use.

WRITTEN TEST

COMMON PESTS

D-3

Name ______________________ Date ________ Score ___

OBJECTIVE 1

Define pest. Define pest in the blanks provided.

____

____

____

OBJECTIVE 2

Explain how pests affect plant and crop growth. Write your answers in the blanks provided.

1. How do insects affect plant and crop growth?

   ____

   ____

2. What do weeds compete with plants for?

   ____

3. What do pests that cause diseases do to plants?

   ____

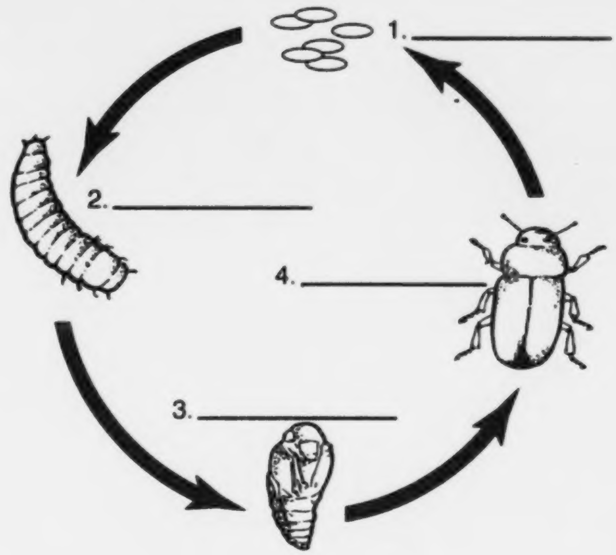
   ____

May be photocopied for student use.

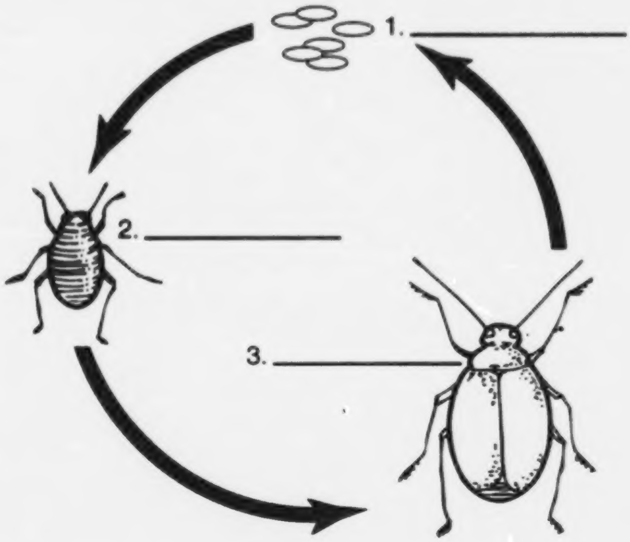
OBJECTIVE 3

Label the stages in the life cycle of common insects. Write the correct stage in the blanks provided.

FOUR-STAGE LIFE CYCLE



THREE-STAGE LIFE CYCLE



May be photocopied for student use.

OBJECTIVE 4

Discuss types of insect damage. Write your answers in the blanks provided.

1. What type of insects most often cause chewed or tattered foliage or blossoms?

____

____

____

2. What type of insect damage causes stippled, flecked, or discolored foliage in plants?

____

____

____

3. What damage can be caused by distortion of plant parts?

____

____

____

4. What types of insects often cause dieback of plant parts?

____

____

____

May be photocopied for student use.

OBJECTIVE 5

Identify insects common to particular crops. Place an "X" in front of correct answers.

ALFALFA

_____ 1. Army cutworm

_____ 2. Red alfalfa aphid

_____ 3. Potato leafhoppers

_____ 4. Variegated cutworm

_____ 5. Indian meal moth

CORN

_____ 6. Chinch bugs

_____ 7. Northeastern corn borer

_____ 8. Southwestern corn borer

_____ 9. Pinworms

_____ 10. Corn earworms

COTTON

_____ 11. Grasshopper

_____ 12. Bollworm

_____ 13. Roundworm

_____ 14. Flea hopper

PASTURE AND RANGE

_____ 15. Granary weevil

_____ 16. Climbing cutworms

May be photocopied for student use.

PEANUTS

____ 17. Greater cornstalk borer

____ 18. Thrips

____ 19. Lesser cornstalk borer

____ 20. Blue spotted aphid

____ 21. Fall armyworms

____ 22. Yellow-striped armyworm

____ 23. Spider mites

SMALL GRAINS

____ 24. Russian wheat aphid

____ 25. Oat aphid

____ 26. European wheat aphid

____ 27. Pale western cutworm

____ 28. Brown wheat mite

____ 29. Bots

____ 30. Spider mite

STORED GRAINS

____ 31. Granary weevil

____ 32. Habronema

____ 33. Lesser grain borer

____ 34. Flour beetles

May be photocopied for student use.

SORGHUM

_____ 35. Grasshoppers

_____ 36. False chinch bug

_____ 37. Spring armyworm

_____ 38. Sorghum greenbug

_____ 39. Corn earworms

_____ 40. Northeastern corn borer

_____ 41. Seedcorn beetle

SOYBEAN

_____ 42. Bean leaf beetle

_____ 43. Green cloverworm

_____ 44. Flying four-winged aphid

_____ 45. Velvetbean caterpillar

_____ 46. Garden webworm

_____ 47. Stink bugs

_____ 48. Ladybugs

_____ 49. Spring armyworm

_____ 50. Three-cornered alfalfa hopper

_____ 51. Loopers

OBJECTIVE 6 **Evaluated on Assignment Sheet 1.**

May be photocopied for student use.

OBJECTIVE 7

State ways weeds hinder crop production. Write ways weeds hinder crop production in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________

OBJECTIVE 8

Identify weeds common to growing area. Place an "X" before correct answers.

ANNUALS

____ 1. Foxtail
____ 2. Lambsquarters
____ 3. Wild mint
____ 4. Dodder
____ 5. Ragweed
____ 6. Barnyardgrass
____ 7. Cattail
____ 8. Downy bromegrass
____ 9. Pigweed
____ 10. Nettles
____ 11. Cheat

May be photocopied for student use.

_____ 12. Henbit

_____ 13. Annual bluegrass

BIENNIALS

_____ 14. Burdock

_____ 15. Wildflowers

_____ 16. Poison hemlock

_____ 17. Hound's tongue

_____ 18. Bull thistle

_____ 19. Southern field cress

_____ 20. Mullein

PERENNIALS

_____ 21. Garden bindweed

_____ 22. Plantain

_____ 23. Field bindweed

_____ 24. Wild parsley

_____ 25. Johnsongrass

_____ 26. Curled dock

_____ 27. Canada thistle

_____ 28. Volunteer grass

_____ 29. Sheep sorrel

_____ 30. Snapdragon

_____ 31. Wild rose

_____ 32. Quackgrass

_____ 33. Sow thistle

May be photocopied for student use.

OBJECTIVE 9

Discuss bird and wildlife damage. Write your answers in the blanks provided.

1. What damage do birds cause and what benefits can birds provide?

   ____

   ____

   ____

2. What damage do rabbits cause to crops?

   ____

   ____

3. Name two rodents and the damage they can cause to crops.

   ____

   ____

   ____

   ____

OBJECTIVE 10

Select from a list indications of plant diseases. Write an "X" before indications of plant diseases.

____ 1. Shriveling and dying fruit

____ 2. Rots

____ 3. Wilting

____ 4. New foliage growth

____ 5. Holes in leaves

____ 6. Long roots

____ 7. Changes in color

May be photocopied for student use.

_____ 8. Necrosis

_____ 9. Stunted growth

_____ 10. Attraction of any insect

_____ 11. Galls

_____ 12. Seepage

_____ 13. Malformations

_____ 14. Excessive foliage from one branch

_____ 15. Dropping leaves, blossoms, and fruits

OBJECTIVE 11

Match causes of infectious plant diseases to their correct descriptions. Write the correct letters in the blanks.

A. Nemoplasms
B. Nematodes
C. Mycoplasms
D. Fungi
E. Strains
F. Bacteria
G. Viruses
H. Microworms

_____ 1. Submicroscopic crystalline particles made up of nucleic acid and protein; multiply only inside living hosts

_____ 2. Living plants that lack chlorophyll and must obtain their food from other living plants or decaying organic matter

_____ 3. Microscopic, single-celled plants that are borne inside a seed or enter a plant through natural openings or injured tissue

_____ 4. Slender, microscopic worms that usually live in the soil, but will attack small plant roots and kill the plant by feeding on its cells and by secreting toxic saliva

_____ 5. Extremely small disease causing agents that live and multiply inside living cells of the host plant; they are devoid of cell walls

OBJECTIVE 12

Evaluated on Assignment Sheet 2.

May be photocopied for student use.

Plant Diseases

ALFALFA	
Disease	Symptoms
Bacterial Wilt	Dwarfed or stunted growth; small abnormally shaped pale green leaves; tissues of infected roots have a yellowish brown discoloration
Leaf Spots (Fungus)	Small brown to black spots on the leaves
Phytophthora Root Rot	Yellowish brown rotted areas on the root; sudden yellowing or reddening and wilting of plant parts; occurs in wet, poorly drained soils during periods such as heavy rainfalls
Verticillium Wilt	Wilting of leaves; yellow or pinkish-orange discoloration on some leaves
Anthracnose	Lower portions of stems have dark diamond shaped lesions; centers of the lesions have small black bodies that produce spores; dead straw-colored stems are an indication
Downy Mildew	Light green to yellow blotches on the leaves; grayish cottony growth on the underside of leaves; dwarfed terminal portions of shoots; twisted leaves; occurs mainly in cool, moist weather
Seed Rot and Damping Off	Brownish to black lesions on young seedlings; rotting of seeds and death of seedlings
Nematodes Root Knot Nematode	Galls on the roots
Stem Nematode	Swollen stems and buds; shortened internodes; deformed leaves and plant parts

May be photocopied for student use.

CORN	
Corn Smut	Grayish-white galls filled with black spores and enclosed by a whitish membrane
Seedling Blight	Seeds decay or seedlings are killed before they emerge; infected seedlings that emerge are stunted and may die
Northern Leaf Blight	Small, elliptical, grayish green water-soaked spots that turn tan; infected areas later enlarge and develop spores
Southern Leaf Blight	Small tan or straw-colored small spots on leaves
Bacterial Wilt	Light-green to yellow streaks along the leaf veins; infected areas later turn tan or brown
Maize Dwarf Mosaic	Light and dark green mottling; later leaves develop red and purple streaks
Corn Stunt	Small, circular yellowish spots at the base of young leaves; joined together to form yellowish stripes on upper leaves; leaves turn yellow and later develop a reddish-purple color; elongation of the ear shanks and a bushy appearance of the plants
Stalk Rot	Weakening and breakage of the stalk generally at the nodes; discoloration and wilting
Ear Rot	Brick-red mold that starts at the tip of the ear and proceeds downward; ears, husks, and kernels develop a pinkish or reddish color (Gibberella ear rot); infected kernels develop a pinkish discoloration (Fusarium ear rot); bleaching of the husks, rotted ear with grayish-brown appearance, white mold on and between the kernels (Diplodia ear rot)
Kernel Rot	Rotting of the kernels
Charcoal Rot	Lower internodes have a straw to dark brown color; vascular strands and the inside of the walls of the stalk are covered with small black bodies called sclerotia; infected stalks break off

May be photocopied for student use.

COTTON	
Disease	Symptom
Seed Decay or Rot	Rotting of seeds; brownish to black lesions on young seedlings; seedlings may be shriveled or not emerge
Black Root Rot	Stunted, blackened epidermal and cortical tissue of hypocotyl below the soil line
Seedling Blight	Darkened, dry or soft rotted lesions near or below the soil line; death of young seedlings
Nematodes	
Root-knot Nematode	Stunted plants; uneven growth and unhealthy appearance; galls or swollen areas on feeder roots
Root Lesion	

PEANUTS	
Disease	Symptoms
Seedling Diseases	Seed rot; death of seedling; dark brown lesions on stems
Aspergillus Crown Rot	Swelling of lower stem below soil line; dark decay develops; limbs or plants wilt and die; crown and root decay; black, powdery mass at decayed crown and stem bases
Limb Rot	Light to dark brown circular sunken lesions on lower branches; infected limbs wilt and die
Southern Blight	Yellowing and wilting of branches or plant; areas turn brown and die; threadlike white, coarse mycelium cover lower stem; mustard seed-like small brown sclerotia on mycelium
Sclerotinia Blight	Branches or entire plants yellow and wilt; light tan to pale white lesions on lower stems; stems die and turn dark brown to black; diseased areas have white mold; black small sclerotia on infected areas
Verticillium Wilt	Mottled leaves; leaf scorch, stunting, yellowing, plant death; brown discoloration of vascular system

May be photocopied for student use.

PEANUTS	
Disease	Symptoms
Early Leafspot	Brown to dark brown circular spots on leaves; often surrounded by a yellow halo; spots appear brown on underside of leaf; infected leaves shed
Late Leafspot	Dark spots with a faint or absent yellow halo that appear black on the underside of the leaf
Web Blotch	Greenish-gray to brownish web-like pattern on upper surface of leaf, later becoming darker brown and progressing to the underside of the leaf
Rust	Yellowish-green fleck on upper leaf surface; later pustules or small raised bumps on lower surface; red to reddish-brown spores
Pod Rot Lesion, ring and root knot nematodes	Light brown to reddish-brown areas on pod; later become black; pod may rot entirely and be soft and mushy or firm and skeletonized; decayed kernels; cream to dark brown mold on kernels and inner pod wall; speckled, blotchy appearance when lesion, root knot, or ring nematodes are present

May be photocopied for student use.

BARLEY	
Disease	Symptom
Seedling Blights and Seed Rots	Seed rot; death of seedling; stunted plants
Covered Smut	Hard, black masses of smut covered with a grayish membrane are noticed in place of kernels; noticeable at heading time
Common Dryland Root or Crown Rot	At maturity areas of sterile heads are noticeable
Loose Smut	Infected heads possess millions of loosely held microscopic black spores that are scattered by wind; the head is destroyed leaving only the naked rachis; noticeable at heading time when dark smutted heads appear

OATS	
Disease	Symptom
Seedling Blights and Seed Rots	Seed rot, death of seedlings, stunted plants
Smut, Covered and Loose	Kernels are replaced by black smut spores in infected panicles; covered smut spores are enclosed within a grayish membrane

May be photocopied for student use.

WHEAT	
Disease	Symptom
Seedling Blights and Seed Rots	Seed rot, death of seedling, stunted plants
Dryland Root Rot	Base of wheat seedlings is discolored chocolate brown; spots of sterile plants can be found at maturity
Bunt or Stinking Smut	Stunted plants; heads have a bluish green color; smut balls replace the kernels of wheat; distinct fishy odor in smut spore filled kernels
Loose Smut	Head is completely destroyed by Black Smut masses; smut spores leave with only the naked rachis remaining; noticeable when wheat heads
Leaf Rust	Small, round, or oval bright orange pustules on green wheat leaves and leaf sheaths
Septoria Leaf Blotch	Round, light brown spots on leaves, speckled with small, dark brown fungus fruiting bodies
Glume Blotch	Irregular chocolate-brown spots, with small, black fruiting bodies
Powdery Mildew	White cotton tufts of fungus mycelium on wheat leaf surfaces; spores from tufts will break loose and appear as white powder
Tan Spot	Dark round lesions on leaves with light to dark brown centers which often have yellow borders
Streak Mosaic	Mottling, yellow-colored streaks along the veins, stunted growth

May be photocopied for student use.

RYE	
Disease	Symptom
Ergot	Hard black or purplish bodies called sclearotia replace the kernels in the heads of plants

SORGHUM	
Disease	Symptom
Covered Smut	Infected seeds are replaced by a mass of dark brown spores (referred to as smut galls) enclosed within a membrane; galls generally remain intact until threshing time when they are broken and spores are distributed to healthy kernels
Loose Smut	Infected seeds are replaced by a mass of dark brown spores enclosed within a membrane; outer membrane generally ruptures when the galls are well developed, distributing spores to healthy plants
Head Smut	A large smut gall is produced at the head of the plant; gall is surrounded by a thin, white membrane which later breaks and spores are released
Leaf Blight	Leaves of infected seedlings have small reddish-purple or yellowish-tan spots; areas enlarge and join together; leaves wilt; seedlings may die or become stunted
Maize Dwarf Mosaic	Mottling of the leaves; stunted growth
Seedling Blight and Seed Decay	Seed rot, death of seedlings, stunted growth

May be photocopied for student use.

SOYBEAN	
Disease	Symptom
Bacterial Blight	Small, irregular spots with water-soaked centers; the center turns yellow then brown as the tissue dies; brown area of diseased spot has a yellow border; spots fall out and leaves become ragged
Bacterial Pustule	Infected leaves have small yellow-green spots with brown centers; small raised pustule develops in center of each spot; leaves become torn and ragged as tissue dies
Anthracnose	Irregular shaped brown areas; infected plant parts become covered with small, black fungal fruiting bodies; pods may contain moldy, dark brown, and shriveled seed or mold growth and no seed
Brown Stem Rot	No external symptoms prior to pod set; later in the season the stems turn brown and there is a sudden blighting and drying of the leaves
Brown Spot or Septoria Leaf Spot	Irregular, dark brown spots on the leaves; lesions are light brown then darken to chocolate brown or black
Charcoal Rot	Wilting; seedlings that are infected have a reddish brown discoloration at the soil line; associated with hot, dry weather
Powdery Mildew	White, powderlike patches of mold growth on stems, cotyledons, leaf surfaces, and pods
Phytophthora Rot	Yellowing and wilting of the plant; brown discoloration of stem and lower branches; root system may be rotted
Stem Canker	Brown to black sunken area on the stem that eventually girdles the stem; upper part of the plant is killed; plant wilts and leaves dry up
Purple Seed Stain	Pink to purple discoloration of parts of the seed coat; infected seeds produce infected seedlings

May be photocopied for student use.

SOYBEAN	
Disease	Symptom
Bud Blight	Terminal bud curves, other buds on the plant turn brown, become dry and break off; pith in the stem and branches becomes brown; infected plants remain green beyond the normal time for maturity
Seed Decay or Rot	Seed may rot or decay in soil
Seedling Diseases, Rhizoctonia and damping-off	Seedlings wilt and die; reddish brown decay of the outer layer of the root and stem
Pythium Rot	Soft, watery rot of seedlings
Diaporthe pod and stem blight	Dark brown lesions on the stem and pods; linear rows of small fruiting structure on the stem which scatter on the pods; seeds may be shriveled and smaller than normal
Sclerotinia Stem Rot	White, cottonlike mycelium fungus on the stem; dark brown to black sclerotia are produced with mycelium on the stem
Downy Mildew	Yellow-green areas on leaves which later become grayish to dark brown with yellow borders; a gray fuzz appears on underside of diseased leaves
Soybean Mosaic Virus	Yellowish vein-clearing; leaf crinkling; diseased seedlings are unhealthy; infected seed may fail to germinate
Nematodes Soybean cyst Root-knot	Stunted growth; yellowing, unhealthy appearance, early maturity; root systems may show damage or be deformed

May be photocopied for student use.

LAP SHEET

CONTROLLING PESTS

D-4

Name ____________________

Check the blank as you complete each step.

1. **Take** ____ the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

2. **Read** ____ the introduction, unit objective, and specific objectives.

3. **Do** ____ the focus assignments.

4. **Stop** ____ and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.

5. **Study** ____ the Information Sheet, objective 1.

Optional: Read ____ one or more of the following Oklahoma State University Fact Sheets:

- ☐ CR-2752 *Weed Control in Soybeans*
- ☐ F-2755 *Bindweed Control in Oklahoma*
- ☐ F-2758 *Weed Control on Rangeland*
- ☐ F-2762 *Chemical Weed Control in Cotton*
- ☐ F-2763 *Chemical Weed Control in Sorghum*
- ☐ CR-2769 *Weed Control in Corn*
- ☐ F-2770 *Weed Control in Winter Wheat*
- ☐ F-2774 *Cheat Control in Wheat*
- ☐ F-7150 *Alfalfa Forage Insect Control*
- ☐ F-7167 *Soybean Insect Survey and Control*
- ☐ F-7170 *Control of Sorghum Insects*
- ☐ F-7174 *Peanut Insect Control in Oklahoma*
- ☐ F-7176 *Insects on Small Grains and Their Control*
- ☐ F-7180 *Stored Grain Insect Control in Oklahoma*
- ☐ CR-7185 *Foliar Disease Control in Wheat*
- ☐ F-7186 *Soilborne Blight Diseases of Peanuts*
- ☐ F-7187 *Viral Diseases of Peanuts*

May be photocopied for student use.

Optional: Write ____ a list of what you believe are advantages and disadvantages to each method.

Optional: Ask ____ your instructor about the Oklahoma Private Pesticide Applicator's license.

6. Study ____ the Information Sheet, objectives 2 and 3. Find out the difference between "general use" and "restricted use" pesticides.

Optional: Read ____ example labels from each type of pesticide and from each classification of pesticide.

7. Study ____ the Information Sheet, objective 4.

Optional: Write ____ a paper on integrated pest management.

Optional: Read ____ OSU Publication CR-7179, *Integrated Control of the Alfalfa Weevil* and F-7307, *Beneficial Insects.*

Optional: Interview ____ a local county extension agent or other pest management specialist about integrated pest management.

8. Study ____ the Information Sheet, objective 5.

9. Find ____ out about different equipment used to apply both liquid and dry chemicals and the types of formulations used.

Optional: Refer ____ to *Applying Pesticides Correctly* or the *Annual Extension Agent's Handbook of Insect, Plant Disease, and Weed Control* for more information.

Optional: Write ____ a list of advantages and disadvantages of the various equipment and formulations available.

May be photocopied for student use.

10. Study ____ the Information Sheet, objectives 6 and 7.

Optional: Refer ____ to *Applying Pesticides Correctly* or the *Annual Extension Agent's Handbook of Insect, Plant Disease, and Weed Control* for more information.

11. Study ____ the Information Sheet, objective 8.

Optional: Write ____ a paper on either biological or cultural control methods. You may write about the control methods overall or choose a specific method or topic.

Optional: Refer ____ to *Applying Pesticides Correctly* for more information.

12. Do ____ Assignment Sheet 1.

13. Stop ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

14. Do ____ Assignment Sheet 2.

15. Stop ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

16. Do ____ Assignment Sheet 3.

17. Stop ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

18. Do ____ Assignment Sheet 4.

19. Stop ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

20. Do ____ Assignment Sheet 5.

21. Stop ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

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22. **Ask** ____ your instructor to demonstrate the guidelines and procedures in Job Sheet 1. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

Optional: Read ____ one or more of the following Oklahoma State University Fact Sheets:

- ☐ F-1215 *Selecting the Proper Nozzle Type and Size*
- ☐ F-1216 *Calibrating a Low Pressure Ground Sprayer*
- ☐ F-1217 *The Low Pressure Ground Sprayer*
- ☐ F-1218 *Pumps for Low Pressure Ground Sprayer*

23. **Practice** ____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

24. **Stop** ____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

25. **Ask** ____ your instructor to demonstrate the guidelines and procedures in Job Sheet 2. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

26. **Practice** ____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

27. **Stop** ____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

28. **Ask** ____ your instructor to demonstrate the guidelines and procedures in Job Sheet 3. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

29. **Practice** ____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

30. **Stop** ____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

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31. **Ask** ____ your instructor to demonstrate the guidelines and procedures in Job Sheet 4. Use the Job Sheet to follow along. Pay careful attention to any guidelines, cautions, and warnings.

32. **Practice** ____ the procedures demonstrated by your instructor. Use the Job Sheet as a guide. Notify your instructor when you are ready to perform the procedures for evaluation.

33. **Stop** ____ and have your instructor evaluate your work from the Job Sheet. After your work has been evaluated, follow your instructor's recommendations.

34. **Take** ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

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WRITTEN TEST

CONTROLLING PESTS

D-4

Name ______________________ Date ________ Score ___

OBJECTIVE 1

List methods of controlling plant pests. Write the methods of controlling pests in the blanks provided.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________

OBJECTIVE 2

Name categories of pesticides and the pests they are used on. Write the names of the pesticides and the pests in the blanks provided.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________

May be photocopied for student use.

OBJECTIVE 3

Discuss the chemical classifications of pesticides. Write your answers to the following questions in the blanks provided.

1. What are inorganic pesticides?

2. What are pesticides that contain carbon, hydrogen, and one or more elements such as chlorine, phosphorous, and nitrogen?

3. What are living micro-organism pesticides?

4. What are pesticides made from plants or plant parts?

OBJECTIVE 4

Explain the principles of integrated pest management. Write your answers to the following questions in the blanks provided.

1. Why does integrated pest management incorporate all aspects of the crop and pest ecosystem?

2. Increased information in an integrated pest management system leads to what?

3. The use of pesticides is balanced by what in an integrated pest management system?

May be photocopied for student use.

4. State two benefits of an integrated pest management system.

OBJECTIVE 5

Match methods of applying pesticides to their definitions. Write the correct letters in the blanks.

A. in-furrow
B. foliar
C. random
D. over-the-top
E. soil injection
F. row
G. drench
H. saturate
I. directed
J. sidedress
K. soil application
L. spot treatment
M. broadcast
N. sheet
O. linear
P. basal
Q. non-soil application
R. band
S. soil incorporation

____ 1. Application to a limited area

____ 2. Application around the lower portion of the stems of woody plants

____ 3. Application that is uniform and applied over a broad area

____ 4. Application to a narrow strip along a crop row

____ 5. Application beneath the soil surface

____ 6. Application to the leaves of the plant

____ 7. Saturation of the soil with a pesticide

____ 8. Application over the top of the crop

May be photocopied for student use.

_____ 9. Application to the soil

_____ 10. Application aimed at a specific target area, such as a portion of a plant

_____ 11. Application in the furrow in which the plant is growing

_____ 12. Application along the side of a crop row

_____ 13. Application by the use of tillage implements which mix the pesticide and the soil

OBJECTIVE 6

List factors to consider when choosing a herbicide. Write factors in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________

May be photocopied for student use.

OBJECTIVE 7

List factors which determine the effectiveness of a pesticide. Write the factors in the blanks provided.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________

OBJECTIVE 8

Describe various biological and cultural control methods. Write your answers to the following questions in the blanks provided.

1. What are predators and parasites?

____

____

____

____

2. What are pathogens?

____

____

____

____

3. What biological control can cause female insects to produce infertile eggs or sterile offspring?

____

May be photocopied for student use.

4. How are pheromones used?

5. What are species-specific chemicals that interrupt the metamorphosis of insects and prevent reproduction by preventing immature insects from maturing?

6. What are trap crops?

7. What does crop rotation include?

8. How does delay of planting reduce the pest population?

May be photocopied for student use.

9. When should crops be harvested?

____

____

OBJECTIVE 9	**Evaluated on Assignment Sheet 1.**
OBJECTIVE 10	**Evaluated on Assignment Sheet 2.**
OBJECTIVE 11	**Evaluated on Assignment Sheet 3.**
OBJECTIVE 12	**Evaluated on Assignment Sheet 4.**
OBJECTIVE 13	**Evaluated on Assignment Sheet 5.**
OBJECTIVE 14	**Evaluated on Job Sheet 1.**
OBJECTIVE 15	**Evaluated on Job Sheet 2.**
OBJECTIVE 16	**Evaluated on Job Sheet 3.**
OBJECTIVE 17	**Evaluated on Job Sheet 4.**

May be photocopied for student use.

HANDOUT 1

Reading a Pesticide Label

All pesticide labels contain information that helps the user to correctly handle, apply, and store the chemical. The sample label in this handout shows the various information that should be included on pesticide labels.

- Use classification (1)

  EXAMPLE: Restricted use

- Trade or brand name (2)
- Ingredient statement (3)
- Common and chemical names (4)

  EXAMPLES: Dodeporph acetate, malathion, diazanon

  ☑ **NOTE:** The chemical name indicates the chemical composition of the active ingredient.

- Signal words and symbols (5)

  ☑ **NOTE:** Signal words tell approximately how toxic the pesticide is to people. Examples of signal words are DANGER, WARNING, CAUTION, POISON.

- Statement of practical treatment (6)

  ☑ **NOTE:** Label includes antidote information for physician or poison control center. Highly toxic chemicals are required to have a statement of practical treatment. Less toxic pesticides will also provide first-aid instructions.

- Name and address of the manufacturer (7)
- Registration and establishment numbers (8)
- Precautionary statement (9)

  ☑ **NOTE:** These statements alert applicators to hazards to the applier, other individuals, animals, and the environment.

May be photocopied for student use.

- Hazards to humans and domestic animals (10)
- Environmental hazards (11)
- Physical or chemical hazards (12)
- Directions for use (13)
- Re-entry statement (14)
- Category of applicator (15)

☑ **NOTE:** Some pesticides may only be used in certain categories of commercial applicators.

- Storage and disposal directions (16)
- Net contents (17)

May be photocopied for student use.

May be photocopied for student use.

PRECAUTIONARY STATEMENTS

⑨

DANGER

⑩ HAZARDS TO HUMANS (& DOMESTIC ANIMALS)

Poisonous by swallowing or inhalation. Do not breathe spray mist. Do not get in eyes. Avoid contact with skin. Wear a mask or respirator of a type passed by the U.S. Bureau of Mines for De Pesto protection. For emergency assistance call 000-000-0000.

TO PHYSICIAN; Do not use oximes such as 2-PAM. Give Atropine 2mg. intravenously or subcutaneously. If in eye instill one drop of Homatrophine.

ENVIRONMENTAL HAZARDS ⑪

This product is toxic to fish, birds and other wildlife. Birds feeding on treated areas may be killed. Keep out of any body of water. Do not apply when weather conditions favor drift from areas treated. Do not contaminate water by cleaning of equipment or disposal of wastes. This product is toxic to bees and should not be applied when bees are actively visiting the area.

⑫ PHYSICAL OR CHEMICAL HAZARDS

WARNING – Flammable! Keep away from heat or open flame.

⑬ DIRECTIONS FOR RESTRICTED USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

RE-ENTRY STATEMENT ⑭

Do not enter area within five days after application.

CATEGORY OF APPLICATOR ⑮

For use only by agricultural pest control applicators.

⑯ STORAGE AND DISPOSAL DIRECTIONS

STORAGE – Store in original container. Do not store next to food or other articles intended for consumption by humans or animals.

DISPOSAL – Do not reuse container. Destroy by burying in a safe place.

OR

Contact State or Regional Federal Authorities for local restrictions on disposal.

①

RESTRICTED USE PESTICIDE

FOR RETAIL SALE TO AND APPLICATION ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION AND ONLY FOR THOSE USES COVERED BY THE CERTIFIED APPLICATOR'S CERTIFICATION.

② PEST-A-WAY

③ ACTIVE INGREDIENT:	*Pestzapper ④	40.50%
INERT INGREDIENTS:		59.50%
TOTAL:		100.00%
	*Betabugazene ④	

This product contains 0.5 lbs of Pestzapper per gallon.
Pestzapper is a registered trademark of Weedy Corporation.

KEEP OUT OF REACH OF CHILDREN

⑤ DANGER — POISON

⑥ STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED – Induce vomiting by giving a tablespoon of salt in a glass of warm water. Repeat until vomitus is clear. Call a physician immediately.

IF INHALED – Remove to fresh air. Call physician immediately.

IF IN EYEs – Flush eyes with plenty of water for at least 15 minutes. Call a physician immediately.

IF ON SKIN – In case of contact, remove contaminated clothing and immediately wash skin with soap and water.

SEE SIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

⑦ MFG BY WEEDY CHEMICALS
TOWN, STATE, USA

⑧ ESTABLISHMENT NO. 0816-YZ-4
EPA REGISTRATION NO. 1033-34

⑬ DIRECTIONS FOR RESTRICTED USE CONTINUED

BLUEBERRIES: For use in controlling the 3-horned berry slurper. Refer to chart and apply recommended amount when pests appear. Observe indicated number of days before harvesting. Do not apply more than once per season.

MINIMUM GALLONAGE REQUIREMENT: Three gallons of mixed spray per acre with ground equipment, one gallon per acre with aircraft.

⑰ NET CONTENTS ONE GALLON

LAP SHEET

NATIVE AND IMPROVED PASTURES

D-5

Name ______________________________

Check the blank as you complete each step.

1. **Take** ____ the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

2. **Read** ____ the introduction, unit objective, and specific objectives.

3. **Do** ____ the focus assignments.

4. **Stop** ____ and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.

5. **Study** ____ the Information Sheet, objective 1.

Optional: Write ____ a short paragraph on each factor explaining in what way you think it afffects pasture management.

6. **Study** ____ the Information Sheet, objective 2.

Optional: Observe ____ forage growth in several areas. Write a short description of the forage growth and how you think the factors may be affecting the growth.

7. **Study** ____ the Information Sheet, objective 3.

Optional: Read ____ *Using Prescribed Fire in Oklahoma,* OSU Extension Fact Sheet F-2865.

Optional: Talk ____ to a local county extension agent or other pasture management specialist about improving grazing.

May be photocopied for student use.

8. **Study** ____ the Information Sheet, objective 4.

Optional: Read ____ *Determining Native Range Stocking Rates*, OSU Extension Fact Sheet No. 2855.

9. **Study** ____ the Information Sheet, objective 5.

Optional: Interview ____ a local livestock rancher about the types of grasses in his or her pasture and how the livestock eat the grass.

10. **Study** ____ the Information Sheet, objective 6.

Optional: Make ____ a list of native grasses common to your area.

11. **Study** ____ the Information Sheet, objectives 7-8.

Optional: Determine ____ the stocking rates of area livestock ranchers.

Optional: Interview ____ a local livestock rancher about the type of grazing system the rancher uses and if the rancher has any problems with grazing.

Optional: Read ____ *Determining Native Range Stocking Rates*, OSU Extension Facts No. 2855; *Short Duration Grazing on Native Range*, OSU Extension Facts No. 2580; and *Forage Planning Guidelines*, OSU Extension Facts No. 2584.

12. **Study** ____ the Information Sheet, objective 9.

Optional: Research ____ the controversy surrounding rangeland use in the western United States. Write a short report on your findings and share them with the class in a brief (3-5 minute) oral report.

Optional: Read ____ *Grazing Forest Range in Eastern Oklahoma*, OSU Extension Fact Sheet.

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Optional: Write ____ a report on a type or species of wildlife that's habitat is native range.

13. **Study** ____ the Information Sheet, objective 10.

Optional: Observe ____ several pastures in your local area and determine their degree of utilization.

14. **Study** ____ the Information Sheet, objective 11.

Optional: Observe ____ an improved pasture in your local area and write a short description of the pasture.

15. **Study** ____ the Information Sheet, objective 12.

Optional: Read ____ *Bermudagrass for Grazing or Hay*, OSU Extension Facts No. 2587; *Bermudagrass Varieties for Oklahoma*, OSU Extension Facts No. F-2583; and *Production and Management of Old World Bluestems*, OSU Extension Facts No. 3020.

Optional: Watch ____ the videos *Grass Identification I* and *Grass Identification II.*

Optional: Make ____ a list of grasses common to your area.

16. **Study** ____ the Information Sheet, objective 13.

Optional: Watch ____ the video *Legume and Wood Plants.*

Optional: Make ____ a list of legumes common to your area.

Optional: Read ____ *Pasture Legumes for Oklahoma*, OSU Extension Facts No. 2585.

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17. **Study** _____ the Information Sheet, objectives 14-15.

Optional: Compare _____ two pastures from similar areas, one of which has been renovated and one which has not been renovated. Write the differences between the pastures.

Optional: Talk _____ to a local county extension agent or other knowledgeable person about pasture renovation.

18. **Do** _____ Assignment Sheet 1.

19. **Stop** _____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

20. **Do** _____ Assignment Sheet 2.

21. **Stop** _____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

22. **Do** _____ Assignment Sheet 3.

23. **Stop** _____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

24. **Do** _____ Assignment Sheet 4.

25. **Stop** _____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

26. **Take** _____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

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WRITTEN TEST

NATIVE AND IMPROVED PASTURES

D-5

Name ______________________ Date __________ Score ____

OBJECTIVE 1

Select from a list factors affecting pasture management. Write an "X" in front of correct factors.

_____ 1. Soil

_____ 2. Availability of pesticides

_____ 3. Geographic region

_____ 4. Distance to the pasture

_____ 5. Intended use of the pasture

_____ 6. Number of people managing the pasture

_____ 7. Annual rainfall

_____ 8. Crop adaptation

OBJECTIVE 2

Name factors that affect forage growth. Write five factors in the blanks provided.

1. ____

2. ____

3. ____

4. ____

5. ____

May be photocopied for student use.

OBJECTIVE 3

List practices that improve grazing. Write six practices in the blanks provided.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________

OBJECTIVE 4

Define animal unit. Write the definition in the blanks provided.

____

____

____

OBJECTIVE 5

Match native grasses to their degree of palatability. Write the correct letters in the blanks provided.

A. very palatable
B. palatable
C. less palatable

____ 1. Annual threeawn
____ 2. Big bluestem
____ 3. Sideoats grama
____ 4. Buffalograss
____ 5. Blue grama
____ 6. Broomesedge bluestem
____ 7. Switchgrass
____ 8. Little bluestem
____ 9. Hairy grama
____ 10. Indiangrass

May be photocopied for student use.

OBJECTIVE 6 | Complete a chart listing characteristics of native grasses.

Complete the following chart.

Grass	Type	Season	Description	Climax	Grazing Value
1. __________	Perennial	Warm	Bunchgrass; flat, bluish-colored basal shoots; folded leaf blades; seed stocks from 2 to 5 feet tall; important forage grass in Eastern Oklahoma (Osage Hills) and the Flint Hills of Kansas	Decreaser	Good
Big bluestem	2.________	Warm	Tall grass; grows in large clumps; very leafy; seed stalks from 3 to 8 feet tall; seed head branches into three parts; lower leaves usually covered in silky hair; quality and quantity among the best of the prairie grasses; overuse and abuse has reduced amount of big bluestem	Decreaser	Excellent
Indiangrass	Perennial	Warm	Tall grass; golden plume-like seed heads 4-12 inches long, stems are 4-8 feet tall; claw-like ligule can be found where the leaf attaches to the sheath; very nutritious and palatable	Decreaser	3.______
Switchgrass	4.________	Warm	Tall grass; sod-forming; has large seed; stalks from 3-6 feet tall; green to bluish-green leaves; small nest of hair where the blade attaches to the sheath	Decreaser	Good
Sideoats grama	Perennial	Warm	Mid-grass; seed stalks are from 18-36 inches tall; small oatlike seeds hang down on one side of the seed stem; flat leaf blades with hairs and bumps along the edges; nutritious; good for conservation	5.______	Good

Grass	Type	Season	Description	Climax	Grazing Value
Hairy grama	Perennial	6.____	Short grass; 10-18 inches tall; tufted bunchgrass with slender stems; basal leaves are hairy on the edges and upper surface	Increaser	Fair
7.__________	Perennial	Warm	Short grass; seed stalks are 10-20 inches tall; narrow leaves form a curly mass of bunchy sod	Increaser	Good
Buffalograss	Perennial	Warm	8. ____________________ ____________________ ____________________ ____________________	Increaser	Good
Wildrye	Perennial	9.____	Several varieties; bunchgrass; 2-4 feet tall; palatable and nutritious	Decreaser	Good
Scribner panicum	Perennial	Cool	Forms small bunches 1-5 inches in diameter; seed stems are 8-15 inches tall; fine, short hairs on underside of the leaf blades; grows between bunches of taller grasses	10._____	Fair
Prairie Threeawn	11. __________	Warm	1-2 feet tall; smooth blades or with a few hairs; each seed has three awns, 1-2½ inches long, attached; unpalatable to livestock	Invader	Poor
Broomsedge bluestem	Perennial	Warm	Mid-tall bunchgrass, stems are 2-4 feet tall; straw-yellow color; unpalatable to livestock	Invader	12.________

OBJECTIVE 7

List ways to prevent overgrazing. Write the four ways in the blanks provided.

1. ____

____

2. ____

____

3. ____

____

4. ____

____

OBJECTIVE 8

Describe different grazing systems. Write a short description of the grazing systems in the blanks provided.

1. ____

____

____

2. ____

____

____

3. ____

____

____

4. ____

____

____

May be photocopied for student use.

OBJECTIVE 9

Match range sites to their description. Write the correct letters in the blanks.

A. steep slopes or ridges
B. bottomland
C. flatland
D. shallow sand
E. deep sand
F. red clay prairie
G. loamy or sandy prairie
H. hard land or claypan prairie
I. rough broken or breaks
J. very shallow or rocky
K. mountain or hill land
L. savannah or rocky savannah

_____ 1. Soil located along creeks and rivers; subject to overflow; very productive and capable of producing large amounts of forage plants such as little bluestem, big bluestem, switchgrass, and Indiangrass

_____ 2. Range areas which are rough and broken by steep slopes, canyons, or gullies; not easily accessible to livestock

_____ 3. Loamy or sandy textured soil with good, deep subsoil which supports highly productive main grasses such as little bluestem, big bluestem, Indiangrass, switchgrass, sideoats grama, blue grama, and buffalograss

_____ 4. Steep, rough, shallow land; very low production

_____ 5. Soil red in color with rolling and broken topography and some gentle slopes which support such grasses as buffalograss, blue grama, hairy grama, big bluestem, Indiangrass, little bluestem, and switchgrass

_____ 6. Vegetative area between forest and prairie grassland with some scattered trees and native grasses

_____ 7. Soil with coarse texture that takes water readily with woody shrubs and tall grasses

_____ 8. Soil less than 10 inches deep and very rocky and rough; production very low and will not stand heavy grazing

_____ 9. Soil with medium or fine textured top soil and moderate or deep subsoil; sites are nearly level to gently sloping upland

May be photocopied for student use.

OBJECTIVE 10

Match degrees of pasture utilization to their description. Write the correct letters in the blanks.

A.	ungrazed	E.	random
B.	variable	F.	minimal
C.	moderate	G.	light
D.	close	H.	severe

_____ 1. Overgrazed, only remnants of good plants are surviving

_____ 2. Only the best plants are grazed

_____ 3. No livestock use

_____ 4. Hedged appearance of shrubs and trampling damage

_____ 5. Uniform grazing of the pasture

OBJECTIVE 11

Select from a list advantages of improved pastures. Write an "X" in front of correct answers.

_____ 1. Increases rate of gain

_____ 2. Eliminates the need for native pastures

_____ 3. Can be used to complement native pastures in a rotational grazing system

_____ 4. Decreases wildlife in the area

_____ 5. Increases carrying capacity of land

_____ 6. A combination of native and improved pastures allows greater flexibility in management and conservation of natural resources

_____ 7. Allows overseeding with legumes, which prolongs grazing season

_____ 8. Less expensive to maintain than native pastures

May be photocopied for student use.

OBJECTIVE 12 | **Complete a chart of important forage grasses.** Complete the following chart.

Grass	Season	Description	Use	Soil Type	Areas Grown
Bahiagrass	Warm	Coarse, numerous basal leaves flat or folded at the base with sparse hairs near the base; deep-rooted; forms a dense sod; once established few species are able to invade it	Pasture	1. ____________ ____________	Florida; lower coastal plains of the southeastern United States
2. ____________	Warm	Small plants ranging from 6" - 24" in height; forms a sod; sensitive to frost	Pasture; hay; silage; lawns; general purpose; and erosion control	Well-drained fertile soils; responds well to nitrogen	Southern portions of the United States
Dallisgrass	3. _____	Deep-rooted bunchgrass; 2-4 feet in height; slender, nearly leafless stems; forms a loose sod	Pasture	Bottom lands with high fertility	From New Jersey south to Tennessee and Florida, west to Texas and California
4. ____________	Warm	Persistent grass that grows from 3 - 6 feet tall; wide-leaves, considered a weed in some areas	Pasture, hay	Fine clay soils with high fertility and water-holding capacity	The Cotton Belt and southern portions of the Corn Belt
Kentucky bluegrass	Cool	Long, smooth, soft leaves; shallow root system; 1-2½ feet tall; forms a dense sod; not drought-resistant; blossoms once a year	5. ____________ ____________ ____________	Sandy loams to clays of high productivity	Northern two-thirds of the United States (does not grow well in arid regions)

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Grass	**Season**	**Description**	**Use**	**Soil Type**	**Areas Grown**
Orchardgrass	6. ____	Long, wide, V-shaped leaves; 2-4 feet tall; forms clumps or bunches	Used alone and in mixture with legumes for pasture, hay, and silage	Most soils except for sandy soils or poorly-drained soils	North central and northeastern United States; Northern Pacific Coast and Great Plains where there is adequate moisture
Perennial ryegrass	Cool	Slightly flattened stems; leaves are folded in the bud; reddish color at the base	Early pasture; lawns	Sandy loams to clays (medium to high fertility)	7. ____________ ______________
8. ____________	Cool	Leaf blades are from 4 to 24 inches long and 1/4 " wide, smooth on the under surface, hairy on the upper surface; 3 feet tall; loose, pyramid shaped seed head; shallow vigorous root system that forms a loose, coarse turf	Used in pasture mixes; hay; soil conservation; suited to wetlands	Wide variety of soils including those that are wet; does well on acid soils	Throughout the United States except dry areas
Reed canarygrass	Cool	Long, broad, light green leaves; forms a dense sod; 4 - 6 feet tall; blooms once a year	9. ____________ ______________ ______________	Fertile, moist soils; also grows well on fertile, well-drained soils	North central and northeastern United States, humid Pacific Coast and Great Plains where there is adequate moisture

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Grass	Season	Description	Use	Soil Type	Areas Grown
Smooth bromegrass	Cool	Long, narrow leaves; 2-4 feet tall; drought-resistant and temperature resistant; forms a heavy sod	Used alone and in mixture with legumes for hay, pasture, and silage	10. ____________ ______________	Corn Belt and somewhat further north
11. ____________	Cool	Deep-rooted; shiny, dark green leaves; 3 - 4 feet tall; bunch type grass; forms a tough sod	Pasture, winter pastures; hay; sometimes toxic because of a fungal mold	Wide variety of soils except coarse, sandy soils	Central and southeastern United States and humid Pacific Coast
Timothy	Cool	Shallow-rooted; long, narrow leaves and smooth stems; 24"-40" in height; bulb-like structures at the base function as food storage organs	Most widely used for hay; provides very palatable early pasture; silage; often mixed with legumes	12. ____________ ______________ ______________	Northeast, cool, humid climates; does poorly in hot, dry areas
Weeping Lovegrass	Warm	Narrow leaves; extensive, shallow root system; drought-resistant	13. ____________ ______________	Wide variety of well-drained soils; prefers sandy loams	Southern Great Plains, southern half of Nevada and California east of the mountains

May be photocopied for student use.

Grass	Season	Description	Use	Soil Type	Areas Grown
Wheatgrasses	Cool		14. ____________ ________________ ________________	Wide variety of soils except sands	Central and northern Great Plains; intermountain regions and higher altitudes of the mountains
Crested wheatgrass		Bunchgrass; 1-3 feet in height; dark green leaf blades; extensive root system; drought resistant			
Western wheatgrass		Bluish-colored stems; 1-3 feet in height; sod-forming			
Quackgrass		Thin, flat blades; vigorous straw-colored rhizomes may extend 3 to 8 feet horizontally; considered a noxious weed in many areas			
15. ____________ ________________	Warm	Bunchgrass; mostly drought and cold tolerant, palatable to livestock; can withstand close grazing; are not closely related to native big and little bluestem	Forage, hay	Loam or clay-loam soils	Southern Great Plains
Plains Bluestem					
WW-Spar					
Caucasian					
Ganada					
King Ranch					
WW-Iron Master					

OBJECTIVE 13 | **Complete a chart of important forage legumes.** Complete the following chart.

Legume	Type	Description	Use	Soil Type	Areas Grown
Alfalfa	Perennial	There are several varieties of alfalfa; usually 24" to 36" in height; flower color varies with variety of alfalfa	Hay, pasture, and silage; for pasture may be mixed with smooth bromegrass, timothy, orchardgrass, and tall fescue	1. ____________ ____________ ____________	A wide variety of regions where there is sufficient moisture
Alsike clover	Perennial	Smooth leaves and stem; continues to bloom and produce flowers over a long period; often will only survive for two years and is treated as a biennial	2. ____________ ____________ ____________	A wide variety of soils except sandy soils; will tolerate poor drainage and acid soils	Northwestern United States; north of Ohio and Potomac rivers, west to the Dakotas
3. ________ ________	Annual	8-12 inches in height; reddish, much-branched stems	Pasture, hay; conservation practices; may be mixed with a companion crop such as oats; its low yield has contributed to a decrease in use	A wide variety of well-drained soils	Southern half of the United States; as far north as Iowa
Birdsfoot trefoil	Perennial	4. ________________ ________________ ________________ ________________	Used for permanent pastures mixed with Kentucky bluegrass or other grass; hay	A wide variety of soil conditions; tolerant of acid soils	Northeastern quarter of the United States to eastern Kansas, Nebraska and the Dakotas; Pacific Northwest
Cicer milkvetch	Perennial	Pale yellow to white flowers; does not cause bloat; reproduces by underground stems	5. ____________	A wide variety of soil condition; tolerates slight acidity to moderate alkalinity	Great Plains and western United States

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Legume	Type	Description	Use	Soil Type	Areas Grown
Crimson clover	Annual	Crimson-colored flowers; may grow to a height of 1-3 feet	6. ________	A wide variety of soils including those that are fairly acid	Southeastern United States
7. ______	Perennial	Variegated white to purple flowers; spreads by creeping underground rootstocks	Erosion control; ground cover; soil improvement; pasture mixtures (its use for grazing is limited because it is unpalatable)	A wide variety of soils	Northern two-thirds of the United States
Hairy vetch	Annual	Purple flowers, nearly hairless; there are several cultivars of vetch	Early-season pasture and hay; soil improvement	8. ________ ________	Throughout the United States; most is grown in southern states for soil improvement during the winter
Red clover	9. ____	Red blossom; 18-30 inches in height; very leafy with fine stems; often treated as a biennial because of the disease anthracnose	Hay, pasture, soil improvement; often grown in combination with other crops; fits well into rotations	A wide variety of soils that are well-drained and non-acid	Northeastern quarter of the United States; eastern Dakotas, Nebraska, Kansas, Oklahoma, and Texas to Atlantic coast; Pacific northwest
Sainfoin	Perennial	10. ____________ ________________ ________________	Pasture, hay	Calcareous soils either dryland or irrigated	Northern Rocky Mountain states

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Legume	Type	Description	Use	Soil Type	Areas Grown
Sericea lespedeza	Perennial	Leafy with coarse to fine stems; will grow to a height of 0.5-1 m; long, narrow leaflets; cream to purple flowers; new cultivars should result in greater use	Hay, pasture; soil conservation	Can grow on infertile or acid soils	11. __________ ____________
Sweet clover	12. _____	Larger, white-flowered varieties may attain a height of 6 feet; yellow-flowered types generally do not grow as tall; care must be taken to avoid bloat; can withstand severe winters without being injured	Pasture, soil improvement; green manure crop	A wide variety of soil types; grows fairly well on less fertile soils or alkaline soils; cannot tolerate acid soil conditions	Central United States and areas of the Great Plains that have adequate rainfall
White clover/Ladino clover	Perennial	White flowers; white clover is low growing generally 5-6 inches or less in height; ladino grows considerable taller; plants have the ability to form roots at every node resulting in new plants	Hay, pasture, silage (ladino); used in combination with other crops	A wide variety of soil types; prefers fertile, moist, well-drained soils	13. __________ ____________ ____________ ____________ ____________
Arrowleaf clover	Annual	Large conical flower heads, initially white flowers that turn pink to purple; often exceed 5 cm; smooth, thick, hollow stems that are often purple, 60-150 cm in length; arrow-shaped leaflets have pronounced veins	14. ____________	Well-drained sandy and clay soils; cannot tolerate high-lime soils or soils with poor drainage	Southeastern United States; from east Texas to South Carolina and southward from Oklahoma and Tennessee to the Gulf of Mexico

OBJECTIVE 14 **State the advantages of renovating pasture land.** Write the advantages in the blanks provided.

1. ____________________
2. ____________________
3. ____________________

OBJECTIVE 15 **Write six steps for renovating pasture land.** Write the steps in the blanks provided.

1. ____________________
   ____
2. ____________________
   ____
3. ____________________
   ____
4. ____________________
   ____
5. ____________________
   ____
6. ____________________
   ____

OBJECTIVE 16 **Evaluated on Assignment Sheet 1.**

OBJECTIVE 17 **Evaluated on Assignment Sheet 2.**

OBJECTIVE 18 **Evaluated on Assignment Sheet 3.**

OBJECTIVE 19 **Evaluated on Assignment Sheet 4.**

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Rangeland Area of the United States

- Grasslands – Grassland ranges encompass over 293 million acres and produce a majority of the natural forage grazing areas. There are eight grassland types.
  - ☐ Plains – Referred to as the Great Plains, includes a wide strip of high land from 5,500 feet elevation on the eastern slope of the Rocky Mountains to 1,500 feet in the Central states
    - Almost all is in private ownership
    - Short, warm season grasses
    - Annual rainfall varies from 10" to 25"
  - ☐ Prairie – Includes the area between the eastern forests and the plains on the west from Canada to parts of Texas
    - Almost all is in private ownership
    - Annual rainfall 20" to 40"
    - Almost treeless because of grazing, drought, and wildfire
    - Introduced species have reduced the prairie
    - Bluestems are the major forage
  - ☐ Mountain, Mountain meadow, and Alpine – Includes areas of the western states and their major mountain ranges; these areas provide feed for livestock and big game, watershed protection, and recreation
    - Annual precipitation of 20" to 50" much of which is snow in higher elevations
    - Mountain grassland consists of fescue grasses, wheatgrasses, and forbs
    - Mountain meadow and Alpine include low grazing grasses and forbs
    - Overuse and abuse has caused controversy and problems for the U.S. Forest Service (the principal administrator of these areas)

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  - Annual – Includes uncultivated valleys and foothills where the elevation is below 2,000 feet; between the Sierra and Cascade ranges and Coast ranges of California
    - Annual rainfall 10" to 30"
    - Cool season annual grasses and forbs
  - Wet – Narrow strips along much of the southern and eastern coastal areas and near major rivers of the southeastern United States
    - Smallest in extent of the grasslands
    - Most productive per acre for forage
  - Desert – Includes areas of the southwest
    - Lowest in forage productivity
    - Annual rainfall 5" to 12"
    - Must have low stocking rates

- Shrublands – Shrublands consist of land in the western United States and include nearly 295 million acres. There are seven types of shrublands.
  - Sagebrush – Northern desert shrub; includes areas of the northwestern and intermountain states; elevations from 2,000 to 10,000 feet
    - Largest and most important for livestock production
    - Annual rainfall 5" to 12"
  - Texas Savanna – Includes areas of south central Texas
    - Mixed trees and shrubs such as mesquite, oaks, and acacia; bluestem, gramagrasses, buffalograss, and threeawn grass
    - Annual rainfall 20" to 30"
  - Southwestern Shrub-steppe – Includes land near the Mexican border in southwestern Texas, parts of New Mexico, and Arizona
    - Includes yucca, mesquite, and gramagrasses
    - Annual rainfall 10" to 18"

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- Desert Shrub – Includes portions of southeastern California, southwestern Arizona, and southern Nevada, portions of Utah and surrounding states
  - Annual precipitation is under 10"
  - Forages are limited in number and undependable
- Pinyon-Juniper – Areas which are mixed in with other shrublands and grasslands
  - Most occur near sagebrush ranges but the soil on these areas is poorer
  - Limited forage
- Chapparal-Mountain Shrub – Occur between grasslands and forests
  - California, Arizona, and Colorado are major areas for this type of range
- Shinnery – Includes sandy areas in eastern New Mexico and the Texas Panhandle
  - Annual rainfall 15" to 25"
  - Vegetation includes open stands of Harvard oak and shinnery oak, and also the productive grasses of the prairie and plains

- Another important area that is separate from rangelands but is used for grazing is forested lands. There are nearly 600 million acres of the lower 48 states that are classified as forest, with over one-third being grazed by livestock.

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LAP SHEET

HARVESTING

D-6

Name ____________________

Check the blank as you complete each step.

1. **Take**	____	the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.
2. **Read**	____	the introduction, unit objective, and specific objectives.
3. **Do**	____	the focus assignments.
4. **Stop**	____	and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.
5. **Study**	____	the Information Sheet, objective 1.
Optional: Interview	____	a producer or other knowledgeable individual about harvesting.
Optional: Read	____	OSU Fact Sheets F-1224, *Combine Operation-Reduce Combine Losses*; F-1225, *Combine Operation-Measuring Loss*; F-1226, *Combine Operation-Adjustment Indicators*; and F-1227 *Combine Operation-Loss Monitors*.
6. **Study**	____	the Information Sheet, objective 2.
Optional: Write	____	a short report comparing hand harvesting with power harvesting.
Optional: Write	____	a short report on a country or region of a country where hand harvesting is still commonplace.

May be photocopied for student use.

7. **Study** ____ the Information Sheet, objective 3.

Optional: Visit ____ a local equipment dealer and observe the equipment used for harvesting.

Optional: Look ____ through current agricultural publications or dealer brochures to find out more about harvesting equipment.

8. **Study** ____ the Information Sheet, objective 4.

Optional: Write ____ a short report on determining correct harvest times of one crop.

9. **Study** ____ the Information Sheet, objective 5.

Optional: Write ____ a short report comparing current average harvesting rates with historical rates.

Optional: Research ____ harvesting rates of common crops in your area.

10. **Study** ____ the Information Sheet, objective 6.

Optional: Research ____ specialty crops grown in your area.

Optional: Write ____ a list of all of the specialty crops, where they might be marketed, and possible problems with production.

11. **Do** ____ Assignment Sheet 1.

12. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

May be photocopied for student use.

13. **Do** ____ Assignment Sheet 2.

14. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

15. **Do** ____ Assignment Sheet 3.

16. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

17. **Do** ____ Assignment Sheet 4.

18. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

19. **Take** ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

May be photocopied for student use.

WRITTEN TEST

HARVESTING

D-6

Name ______________________ Date ________ Score ___

OBJECTIVE 1

Explain the importance of harvesting efficiently. Write your answers in the blanks provided.

1. What can directly affect the profit or loss a producer realizes from a crop?

____

____

2. What are the types of losses in harvesting?

____

____

____

____

3. What may cause a lower market value for crops?

____

____

4. What must the producer do before the crops can be marketed?

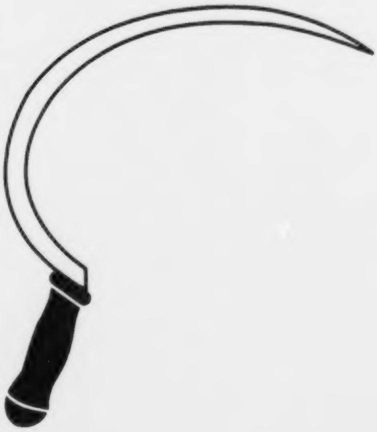
____

____

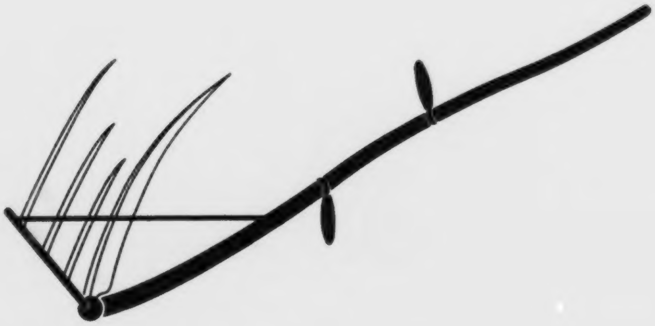
May be photocopied for student use.

OBJECTIVE 2

Identify types of hand harvesting equipment. Write the name of the equipment in the blank provided.



1. ____________



2. ____________

May be photocopied for student use.

OBJECTIVE 3 **Name types of power harvesting equipment.** Write the names in the blanks provided.

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

OBJECTIVE 4 **Select from a list factors to consider when determining correct harvest times.** Write an "X" in front of correct factors.

____ 1. Moisture content

____ 2. Availability of harvesting equipment

____ 3. Number of days from full bloom

____ 4. Stage of development of the plant

____ 5. Price of the crop

May be photocopied for student use.

OBJECTIVE 5

Match common field crops to their average harvesting rate. Write the correct letters in the blanks.

A. 29 bu/A
B. 5 tons/A
C. 49 bu/A
D. 37 bu/A
E. 119 bu/A
F. 60 bu/A
G. 1.7 tons/A
H. 343 lbs/A
I. 39 bu/A
J. 24 bu/A
K. 15 bu/A
L. 3.6 tons/A
M. 2274 lbs/A
N. 20 bu/A

_____ 1. Barley

_____ 2. Corn for Grain

_____ 3. Cotton Lint

_____ 4. Oats

_____ 5. Peanuts

_____ 6. Rye

_____ 7. Soybeans

_____ 8. Grain Sorghum

_____ 9. Winter Wheat

_____ 10. Alfalfa Hay

_____ 11. Other Hay

May be photocopied for student use.

OBJECTIVE 6

Complete statements about harvesting specialty crops. Write the correct words in the blanks provided.

1. Harvesting specialty crops can be management and ______________ intensive.
2. Specialty crops often must be ______________ immediately after harvesting for freshness or season.
3. Specialty crops may require ______________ equipment and/or storage facilities.
4. Some specialty crops must be ______________ frequently during the harvesting season.
5. Specialty crops often have to be ______________ by hand.

OBJECTIVE 7 **Evaluated on Assignment Sheet 1.**

OBJECTIVE 8 **Evaluated on Assignment Sheet 2.**

OBJECTIVE 9 **Evaluated on Assignment Sheet 3.**

OBJECTIVE 10 **Evaluated on Assignment Sheet 4.**

May be photocopied for student use.

LAP SHEET

MARKETING CROPS AND GRADES

E-1

Name ____

Check the blank as you complete each step.

1. **Take** ____ the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

2. **Read** ____ the introduction, unit objective, and specific objectives.

3. **Do** ____ the focus assignments.

4. **Stop** ____ and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.

5. **Study** ____ the Information Sheet, objective 1.

Optional: Write ____ a brief report on how one variable affects the marketing process for farmers.

Optional: Talk ____ to your local county extension agent about variables that make up the marketing process.

6. **Study** ____ the Information Sheet, objective 2.

Optional: Monitor ____ the media to identify an advertising campaign for a food product.

Optional: Contact ____ local newspapers and television and radio stations about the cost to run that campaign locally and nationally.

Optional: Write ____ a short report about your findings.

May be photocopied for student use.

Optional:
Contact _____ your local county extension agent to learn the location of commercial storage facilities in the region and your general area.

Optional:
Calculate _____ mileage to the various facilities and the difference in cost for transporting items roundtrip to each.

7. Study _____ the Information Sheet, objective 3.

Optional:
Contact _____ a local grocery to learn the cost of two food items related to the same commodity, one of which is fresh and the other somehow processed, then...

Optional:
Brainstorm _____ about the various expenses each product is likely to have incurred in order to reach its current state, and which product is likely to provide the largest farmer's share.

Optional:
Write _____ a short report about what you determined and how much profit agribusinesses should expect to make on their investment.

8. Study _____ the Information Sheet, objective 4.

Optional:
Write _____ a brief report on when it would be most advantageous for farmers to sell by the bushel and when they would find it most profitable to sell by the pound.

9. Study _____ the Information Sheet, objective 5.

Optional:
Brainstorm _____ about situations that would make it appear wise to sell immediately, and those which would seem to indicate it would be best if farmers waited to market their crops.

May be photocopied for student use.

10. **Study** _____ the Information Sheet, objective 6.

Optional: Read _____ *Grain Storage Costs in Oklahoma*, OSU Extension Facts, No 210.

Optional: Write _____ a one to two paragraph report on what you consider to be the most important pros and cons of both on-farm storage and commercial storage.

11. **Study** _____ the Information Sheet, objective 7.

Optional: Visit _____ a local country point elevator.

Optional: Research _____ the advantages and disadvantages for the average local farmer in using either a country point or a terminal elevator.

Optional: Write _____ a short report about your findings.

12. **Study** _____ the Information Sheet, objective 8.

Optional: Bring _____ a picture or an actual sample of damaged kernels to class.

Optional: Write _____ a short report on the type of damage your pictured or sample kernels have undergone and how the damage likely occurred.

13. **Study** _____ the Information Sheet, objective 9.

Optional: Write _____ a short report about a specific marketing channel.

14. **Study** _____ the Information Sheet, objective 10.

Optional: Talk _____ to a local commodities broker or the county extension agent about the futures market, forward marketing, and hedging.

May be photocopied for student use.

Optional: Read ____ *Wheat Futures Contract Risk and Returns*, OSU Extension Facts, No. 518.

Optional: Write ____ a short paper on one of the following: forward marketing, the futures market, or hedging.

15. Study ____ the Information Sheet, objective 11.

Optional: Brainstorm ____ about the types of marketing information you'd find most useful as a farmer.

Optional: Contact ____ a trade association, state or federal agency, or private news agency to obtain a copy of some type of market news.

Optional: Write ____ a short paper on how you obtained the market news, what type of background or education someone would need to interpret the data it contains, and if you would find this information helpful if you were a farmer.

16. Study ____ the Information Sheet, objective 12.

Optional: Visit ____ a direct farm outlet.

Optional: Talk ____ to a representative from a local coop or bargaining association about the services their organization provides to its members.

17. Study ____ the Information Sheet, objective 13.

Optional: Research ____ U.S. agricultural imports, then...

Optional: Identify ____ one crop that is likely to grow in Oklahoma and for which a market seems to exist (or could easily be created) that isn't currently being filled by another U.S. commodity.

May be photocopied for student use.

Optional: Write	____	a short report on your findings.
Optional: Read	____	*Alternative Crop Development in Oklahoma*, OSU Current Report 2102, and *Taking Advantage of Alternative Agricultural Opportunities*, OSU Extension Facts, No. 869.
18. Study	____	the Information Sheet, objective 14.
Optional: Talk	____	to your local county extension agent about local farmers who have been successful in obtaining funding for an alternative agricultural enterprise.
Optional: Complete	____	a loan application for an alternative agricultural enterprise.
Optional: Write	____	a short paper debating the wisdom of starting with a large operation versus starting small and growing.
19. Do	____	Assignment Sheet 1.
20. Stop	____	and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.
21. Do	____	Assignment Sheet 2.
22. Stop	____	and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.
23. Do	____	Assignment Sheet 3.
24. Stop	____	and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.
25. Take	____	the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

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WRITTEN TEST

MARKETING CROPS AND GRADES

E-1

Name ______________________________ Date __________ Score ____

OBJECTIVE 1

Describe variables that make up the marketing process. Write a short answer to each question.

1. Name three ways in which weather can affect the marketing process.

____

____

____

2. What are five things that consumer needs help to dictate?

____

____

____

____

____

3. Name two things crop conditions help to determine.

____

____

____

4. What impacts on the number, type, and size of government loans that are available to farmers?

____

____

____

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OBJECTIVE 2

Complete statements about factors that add dollars to the marketing cost of products. Fill in the blanks.

1. Although ______________ can greatly add to the cost of marketing products, individual farmers seldom have to incur this cost.
2. The cost for ______________ goes up in proportion to the distance between the farm where a product is developed and the place where it is sold to the consumer.
3. The length of time an item is stored and the type of facility where it must be kept helps to determine ______________ costs.
4. ____________ costs are estimated to equal one third of the total marketing costs for all food products.

OBJECTIVE 3

Discuss factors that influence the share which producers receive on commodities. Write a short answer to each question.

1. On what products do farmers receive the highest percentage?

   ____

   ____

   ____

2. Name the two things that determine the farmer's share of the eventual retail price of a commodity.

   ____

   ____

   ____

May be photocopied for student use.

3. List five factors that affect how much agribusinesses have to spend for a product.

____

____

____

____

____

OBJECTIVE 4

Discuss factors which determine whether to sell by the pound or by the bushel. Write a short answer to each question.

1. What are the two things that determine whether a crop is sold by the pound or by the bushel?

____

____

____

____

2. List three things that cause the moisture content of crops to vary.

____

____

____

____

May be photocopied for student use.

OBJECTIVE 5

Discuss factors which influence time to market. Write a short answer to each question.

1. List the five main factors that influence time to market.

2. What may it be best to do if price trends or cycles indicate the price for a commodity may peak at a certain time?

3. What should you probably do if storage costs are low and crop prices are expected to rise?

4. In regard to supply and demand, when is it best to market?

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OBJECTIVE 6

Discuss the advantages and disadvantages of home storage and commercial storage. Write a short answer to each question.

1. Name three advantages of home storage.

____

____

____

____

____

____

2. Name one disadvantage of home storage.

____

____

3. Name three advantages of commercial storage.

____

____

____

____

____

4. Name one disadvantage of commercial storage.

____

____

May be photocopied for student use.

OBJECTIVE 7

Explain the types of elevators. Write a short answer to each question.

1. What are the two types of elevators?

____

____

2. List three characteristics for each.

____

____

____

____

____

____

OBJECTIVE 8

List factors which determine the federal grades of grain. List the factors below.

1. List five factors, other than damage, that are taken into consideration in grading grain.

____

____

____

____

____

513

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2. Name ten types of damage that impact the grading of grain.

OBJECTIVE 9

Compare marketing channels. Write your answer to each question in the blanks.

1. What do all market channels have in common?

2. What advantage does the classic market channel offer farmers?

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3. In addition to a large crop and their own transportation, what must farmers have to successfully deal directly with processors?

4. Explain the volume and quality requirements for farmers who market directly to retailers.

5. What type of commodity must be involved before farmers can market directly to wholesalers?

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OBJECTIVE 10

Explain the principles of using forward marketing, the futures market, and hedging. Write a short answer to each question.

1. Why do farmers sell futures on commodities?

2. Which farmers use hedging?

3. What does a forward marketing contract establish?

4. What are futures contracts usually NOT intended to accomplish?

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OBJECTIVE 11

List sources of crop marketing information. List sources below.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________

OBJECTIVE 12

List methods of marketing crops. Write your answer to each question.

1. List three direct outlets.

____
____
____

2. List three non-direct outlets.

____
____
____

3. List three group marketing functions.

____
____
____
____

4. List two types of marketing cooperatives.

____
____

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OBJECTIVE 13

Discuss markets for specialty crops. Write your answer in the blanks.

1. What can you NOT rely on exports to do for specialty crops?

2. What generally prove to be the most successful specialty crops in this country?

3. Name three markets for which specialty crops are always needed.

OBJECTIVE 14

Discuss sources of funding for nontraditional enterprises. Write your response to each question.

1. Who can receive loans under OALDP? (name two groups)

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2. What national organization provides loans for alternative agricultural enterprises?

3. What must applicants possess to qualify for a FmHA alternative agricultural enterprises loan?

OBJECTIVE 15 **Evaluated on Assignment Sheet 1.**

OBJECTIVE 16 **Evaluated on Assignment Sheet 2.**

OBJECTIVE 17 **Evaluated on Assignment Sheet 3.**

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LAP
SHEET

PRICE TRENDS AND CYCLES

E-2

Name ____

Check the blank as you complete each step.

1. **Take**	____	the pretest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.
2. **Read**	____	the introduction, unit objective, and specific objectives.
3. **Do**	____	the focus assignments.
4. **Stop**	____	and have your instructor evaluate your work from the focus assignment. After your work has been evaluated, follow your instructor's recommendations.
5. **Study**	____	the Information Sheet, objective 1.
Optional: Read	____	*Oklahoma Agricultural Trends*, OSU Extension Bulletin 805.
Optional: Write	____	a report on one of the trends in the bulletin.
6. **Study**	____	the Information Sheet, objective 2.
7. **Ask**	____	your instructor to explain supply and demand.
Optional: Draw	____	supply and demand curves.
Optional: Write	____	a report on how a government program has affected the supply of any commodity in the past ten years.
Optional: Write	____	your ideas about how technology is likely to affect the supplies of future crops. Discuss specific commodities.

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8. **Study** ____ the Information Sheet, objectives 3 and 4.

Optional: Write ____ a short personal opinion paper about whether you feel changes in the public's acceptance of smoking is likely to affect the demand for tobacco in the future. And if so, how that is likely to affect the tobacco farming industry.

Optional: Interview ____ adults in your extended family about any changes they ever made in their purchase of farm commodities due to a shift in their disposable income.

Optional: List ____ on a piece of paper, under either "positively affected" or "negatively affected" all the items your relatives mentioned when you interviewed them.

9. **Study** ____ the Information Sheet, objective 5.

Optional: Develop ____ a game that demonstrates how world production and consumption affects a commodity.

Optional: Explain ____ the game to your instructor.

10. **Study** ____ the Information Sheet, objective 6.

Optional: Write ____ a short essay comparing the production of one country not covered in the Information Sheets with U.S. production

Optional: Report ____ briefly (2-3 minutes) to your instructor on your essay.

11. **Study** ____ the Information Sheet, objective 7.

Optional: Draw ____ shifts in the supply and demand curve and see whether prices would rise or fall.

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Optional: Write ____ a short report (one page) on how production levels affect price.

12. **Study** ____ the Information Sheet, objective 8.

Optional: Write ____ a short paper on the pros and cons of the various price discovery methods.

13. **Do** ____ Assignment Sheet 1.

14. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

15. **Do** ____ Assignment Sheet 2.

16. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

17. **Do** ____ Assignment Sheet 3.

18. **Stop** ____ and have your instructor evaluate your work from the Assignment Sheet. After your work has been evaluated, follow your instructor's recommendations.

19. **Take** ____ the posttest provided by your instructor. Have your instructor evaluate your completed test. After your test has been evaluated, follow your instructor's recommendations.

May be photocopied for student use.

WRITTEN TEST

PRICE TRENDS AND CYCLES

E-2

Name ______________________ Date __________ Score ____

OBJECTIVE 1

Discuss trends and cycles in the marketing of crops. Write your answers in the blanks.

1. What is a trend?

____

____

____

2. How much time should you take into consideration in determining a crop trend?

____

____

____

3. How is a cycle similar to a trend?

____

____

____

____

4. How do cycles and trends differ?

____

____

____

May be photocopied for student use.

5. Why is it important for farmers to be aware of trends and cycles?

OBJECTIVE 2

Discuss supply and demand. Write your answers in the blanks.

1. What is supply?

2. What is demand?

3. Finish this statement: Products are considered to have an inelastic demand if

5. What is the law of demand?

6. What is the law of supply?

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OBJECTIVE 3

List factors that can affect the supply of a commodity. Write six factors in the blanks provided.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________

OBJECTIVE 4

Describe factors that cause shifts in the demand for a commodity. Write your answers in the blanks.

1. List the factors that affect demand for a commodity.

____

____

____

____

2. How does disposable income affect demand?

____

____

____

3. How does population size affect demand?

____

____

____

May be photocopied for student use.

4. If consumers can purchase substitute goods at a lower price what may happen to demand for a specific commodity?

____

____

____

OBJECTIVE 5

Describe the effect that world production and consumption has on a commodity. Write your answers in the blanks.

1. What happens when the world starts to consume a product?

____

____

____

2. If this country had no exports, what would happen to our farm production and why?

____

____

____

3. What type of imports have little effect on demand for U.S. products?

____

____

____

4. What happens when other countries produce the same products the U.S. produces?

____

____

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OBJECTIVE 6

Rank countries according to their production of various commodities. Write a 1 in front of the country producing the most metric tons a given commodity, a 2 in front of the next, and so on.

1. Cereal

   ___ Bangladesh

   ___ Canada

   ___ China

   ___ former Soviet Union

   ___ United States

2. Soybeans

   ___ Canada

   ___ China

   ___ Japan

   ___ former Soviet Union

   ___ United States

3. Fruits

   ___ Australia

   ___ China

   ___ Japan

   ___ United States

   ___ former West Germany

May be photocopied for student use.

4. Vegetables

___ China

___ Japan

___ former Soviet Union

___ United States

___ former West Germany

OBJECTIVE 7

Discuss factors affecting prices for farm commodities. Write your answers in the blanks.

1. Explain what happens when either supply or demand changes.

____

____

____

2. Give two examples.

____

____

____

OBJECTIVE 8

Discuss pricing effectiveness. Write your answers in the blanks.

1. Explain how price determination is most effectively used.

____

____

____

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2. In what ways can price determination NOT be used?

3. How does price discovery differ from price determination?

4. Name three of the practices used for price discovery.

5. Why is there a high level of risk involved in using price discovery?

OBJECTIVE 9	**Evaluated on Assignment Sheet 1.**
OBJECTIVE 10	**Evaluated on Assignment Sheet 2.**
OBJECTIVE 11	**Evaluated on Assignment Sheet 3.**

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Soil, Plant, and Crop Science

Student Workbook

Part 1

Developed by the
Curriculum and Instructional Materials Center
for the Division of Agricultural Education
Oklahoma Department of Vocational and Technical Education

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Curriculum and Instructional Materials Center

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TABLE OF CONTENTS

Student Workbook

One set per unit of Objective Sheets, Information Sheets, Assignment Sheets, and Job Sheets for the following units:

SECTION A

Unit 1 Introduction to Soil, Plant, and Crop Science A1-1
Unit 2 Safety A2-1
Unit 3 Careers A3-1

SECTION B

Unit 1 Soils B1-1
Unit 2 Soil Sampling B2-1
Unit 3 Fertilizers and Irrigation B3-1
Unit 4 Soil Conservation Practices B4-1

SECTION C

Unit 1 Land Uses and Classification C1-1
Unit 2 Land Legal Descriptions C2-1

SECTION D

Unit 1 Growth and Reproduction D1-1
Unit 2 Seeds and Plants: Selection, Preparation, and Planting D2-1
Unit 3 Common Pests D3-1
Unit 4 Controlling Pests D4-1
Unit 5 Native and Improved Pastures D5-1
Unit 6 Harvesting D6-1

SECTION E

Unit 1 Marketing Crops and Grades E1-1
Unit 2 Price Trends and Cycles E2-1

OBJECTIVE SHEET — INTRODUCTION TO SOIL, PLANT, AND CROP SCIENCE — A-1

INTRODUCTION

Soil, plant, and crop science have played, and continue to play, an important role in the history of human civilizations. The ancient Egyptian civilization was made possible by the rich fertile soil near the Nile River. In the United States today, less than three percent of the population produces our food. Soil, plant, and crop science are important to farmers who must maintain productivity while managing the natural resource of soil. Soil, plant, and crop science are also important to those who depend on the products produced by farmers.

Plants have many uses other than food that are important to our society. Plants are used for many chemical and medicinal purposes. Every day we use many products in every aspect of life that are produced through the knowledge of soil, plant, and crop science.

PREREQUISITE

None

FOCUS ASSIGNMENTS

FOCUS ASSIGNMENTS	
PREREADING:	Read the handout *This Is Not Dinner.*
WRITING:	Write a short (one paragraph to one page) discussion on non-agricultural uses of plants. Include a discussion of why you believe these uses might be important in the future.

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheet and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Define soil.
2. State reasons why soil is important.
3. List the factors responsible for soil formation.
4. Describe how plants use soil.
5. Discuss how trends affect agricultural production.
6. Identify environmental issues affecting plant agriculture.
7. Describe the relationship between livestock and crop production.
8. Describe non-agricultural uses of plants.
9. Use the binomial system of plant classification.
10. Survey crops grown in your area. (Assignment Sheet)

INFORMATION SHEET — INTRODUCTION TO SOIL, PLANT, AND CROP SCIENCE — A-1

OBJECTIVE 1

Optional Activities/
Resources in
Instructor's Guide

Define soil.

WORDS YOU SHOULD KNOW	
medium	a substance that is the natural environment for an organism

Soil is the combination of mineral and organic material on the earth's surface that is a natural medium for the growth of land plants.

☑ **NOTE:** There are many different types of soils. Differences in soil are primarily because of the types of rock that formed the soils. Differences in soil can also be caused by climate, topography, plant and animal life, stage of the development of the soil material, and type of farming operations on the soil. Soils are constantly changing and developing.

OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

State reasons why soil is important.

- Soil is necessary for life and interacts with the earth's atmosphere and crust to provide life with vital resources.
- Soil is a medium for the growth of land plants.
- Agricultural uses of soil provide for the production of food, fiber, forest products, feed and grazing land for animals, and plants for exterior and interior landscaping.
- Non-agricultural uses of soil provide for recreation areas, building foundations, waste disposal, and building materials.

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

List the factors responsible for soil formation.

WORDS YOU SHOULD KNOW

parent material	minerals and rock from which soil develops
topography	the surface contour of the earth
weathering	the chemical and physical actions which causes disintegration and decomposition of rocks on exposure to weather

- Parent material

  EXAMPLES: Sandstone, shale, granite bedrock, limestone

- Climate

  ☑ **NOTE:** Soil is first affected by climate in the weathering of rock. Climate continues to affect soil formation primarily because of temperature and rainfall.

- Biological activity

  ☑ **NOTE:** Plants, animals, and microorganisms affect soil formation. Plants help break down rocks and add organic matter to the soil. Microorganisms break down plant material into organic matter. Earthworms and burrowing animals, such as moles, also affect soil formation.

- Topography

  ☑ **NOTE:** Topography affects soil formation primarily by affecting water movement.

- Time

  ☑ **NOTE:** Farming practices such as deep ploughing and artificial drainage can also affect soil formation.

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Describe how plants use soil.

Plants depend on soil for four primary needs:

- **Support** – Soil anchors the roots of a plant which supports the stem and leaves as they grow toward the sunlight.
- **Water** – Soil holds water which is critical for plant survival.
- **Oxygen** – Plant roots require oxygen which is held in the soil.
- **Nutrients** – The majority of the essential nutrients for plant life are available in the soil.

OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Discuss how trends affect agricultural production.

- The tremendous increase in world population has created pressure on agriculture to be more productive.
- As the standard of living rises, people demand a higher quality diet; emphasis is placed on producing leaner meats, vegetables with high grade fiber and low saturated fats, etc.
- As technology improves, farm productivity increases and farming has become more complex.

  ☑ **NOTE:** Farming today is highly mechanized and depends on fossil fuels for its high productivity.

- The amount of land available for farming is limited, and the opportunities for bringing land into production by irrigation are offset by the use of land for commercial development.

OBJECTIVE 6

Identify environmental issues affecting plant agriculture.

Optional Activities/
Resources in
Instructor's Guide

☑ **NOTE:** Environmental issues which affect plant agriculture include both those which are directly or indirectly caused by agricultural operations and those which are caused by unrelated factors but which can affect plant agriculture.

- Pollution by fertilizer nutrients

  EXAMPLES: Nitrogen and phosphorus

- Pollution by pesticides

- Wastewater

- Solid wastes

  ☑ **NOTE:** Solid wastes include animal manures, sewage sludges, food-processing wastes, garbage composts, etc. These solid wastes are being added to soils and the organic matter is usually beneficial to soil productivity. The environmental effect of adding solid wastes to soils depends on many factors and is often controversial.

- Increasing salinity of soil and water

  ☑ **NOTE:** Irrigation of crops can draw salt water which will increase the salinity of the soil.

- Soil erosion

- Diminishing water supplies

  ☑ **NOTE:** The draining down of aquifers through irrigation can over tax the ground water supply causing wells to go dry.

- Diversion of land to non-agricultural uses

  EXAMPLE: Subdivisions

- Pollution by petrochemicals

  EXAMPLE: Plant products may be able to replace products used in the petrochemical industry.

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

Describe the relationship between livestock and crop production.

WORDS YOU SHOULD KNOW	
forage crop	a crop that is grown for edible plant parts other than the seed; usually refers to hay and pasture

- Hay and pasture crops are a vital part of the livestock industry. Livestock, such as beef cattle and dairy cattle, rely on forage for much of their nutritional needs.

- Crops may serve as both forage and as grain.

  EXAMPLES: Corn, sorghum, winter wheat

- Crops may serve as both pasture and hay.

  EXAMPLE: Alfalfa

- Price variations in hay will have financial and management effects on the livestock producer.

  EXAMPLE: If the price of hay increases, it will cost more for the livestock producer to feed cattle during the winter.

OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

Describe non-agricultural uses of plants.

WORDS YOU SHOULD KNOW	
lignocellulose	the largest component of plant matter; a mixture of cellulose, hemicellulose, and lignin which compose the essential part of woody cell walls

- Plants are used in the chemical industry for a variety of products. The primary materials from plants used in the chemical industry are oils, starches, and lignocellulose materials.

- Vegetable oils are the oils that can be extracted from the fruits or seeds of plants.
    - Seed oils from traditional crops such as soybeans, corn, cotton, coconuts, and flax provide raw materials for many of our everyday products such as soap and grease for lubricating automobiles.
    - Oils from new crops, such as crambe and rapeseed, produce oils that are used in products such as lubricants, plastics, and cosmetics.
    - The fatty acids of soybean oil and tall oil (from wood) are used in glue products; fatty acids in coconut oil are used in soaps and detergents. Other uses of fatty acids include fabric softeners, cosmetics, plastics, paints, coatings, and inks.
- Essential oils are the products obtained from steam distillation or solvent extraction of aromatic plants, such as spices and culinary herbs. Essential oils are used in fragrances, flavor applications, and medicine.

  EXAMPLES: Geranium oil, jasmine
- Starches are found in plants such as corn, potatoes, tapioca, rice, and wheat and have uses in the chemical industry.
    - The paint and coatings industry uses starches as stabilizers and flow modifiers in latex paints.
    - Starches are used in adhesive products.
    - Starches are used as a binder in explosives and also in the textile industry to size textiles.
    - Modified starches are used extensively in the paper industry.
    - Starch-derived materials, which are biodegradable, are primary candidates to replace nondegradable petroleum-derived plastics.

- ☐ Lignocellulose materials, the largest component of plant matter, is a mixture of cellulose, hemicellulose, and lignin.
    - ▸ Lignocellulose materials are used in the wood and paper pulp industry.
    - ▸ Lignocellulose materials can provide raw materials identical to those used in the existing petrochemical industry.

- Plant products are used in the pharmaceutical/medicinal industries to produce a variety of health products.
    - ☐ Plant products may be used as chemotherapeutic agents and as cancer prevention agents.

      ☑ **NOTE:** There is still much research that needs to be done regarding plant products as cancer treatment and/or prevention agents. Antioxidants, found in some plants, are thought to reduce the risk of heart disease, cancer, and other illnesses.

    - ☐ Plant products are used in many medicines.

      EXAMPLES: Capsaicin, the major ingredient in red pepper, is used in medications for such ailments as arthritis; corticosteroids are made from by-products of soybean processing; eucalyptus oils are used in some medicines

- Plant products are used in the transportation industry.
    - ☐ Biofuels, materials that are biological in nature and used to produce energy, can provide fuel for transportation and help reduce air pollution from traditional fossil fuels.

      EXAMPLE: Ethanol

OBJECTIVE 9

Optional Activities/
Resources in
Instructor's Guide

Use the binomial system of plant classification.

WORDS YOU SHOULD KNOW

binomial name	the scientific plant name, which consists of two Latin names
common name	popular, familiar, or local plant name; most plants have more than one common name
genus	a group of species, a subdivision of a family (the plural of genus is "genera")

- All plants are placed in one of three major groups: the thallophytes, the bryophytes, and the tracheoplytes.
  - ☐ The thracheophytes, or vascular plants, include the plant life which is the most highly developed. The well-developed roots, stems and leaves of vascular plants transport materials throughout the plant and allow the plant to store reserve water supplies.
    - ▸ Important groups of vascular plants include the pteriodphytes, the gymnosperms, and the angiosperms.
    - ▸ Angiosperms reproduce by seeds and include the major portion of crops grown for food.

      EXAMPLES: Corn, oats, wheat, barley
- A family is a subdivision within a class of plants, such as the angiosperms, whose members have characteristics that are similar.
  - ☐ There are two primary families for field crops: the Gramineae, or Grass Family, and the Leguminosae, or Legume Family.
- The first name in the binomial name is known as the generic name; all plants having the same generic name belong to the same genus.

  EXAMPLE: The generic name for clover is *Trifolium*

- The second name in the binomial name is the specific name; all plants having the same specific name belong to the same species.

  EXAMPLE: White clover is known as *Trifolium repens.*

- Some species are subdivided into varieties.

  ☑ **NOTE:** One variety of a species may resemble another variety, but there are always one or two differences that are consistent and inherited. For example, the nectarine tree, *Prunus persica var nectaria,* is a variety of the peach tree, *Prunus persica.*

- Procedures for scientific naming – Because scientific names are written in Latin, a foreign language, they are written in *italics*. Certain other customs apply when expressing scientific names:

- Genus
  - ☐ always written first
  - ☐ begins with a capital letter
  - ☐ usually a noun

- Species
  - ☐ always written last
  - ☐ begins with a lowercase letter
  - ☐ usually an adjective

☑ **NOTE:** An important advantage of scientific names is that they are universal. The names will be understood in every country.

OBJECTIVE 10 **Complete the Assignment Sheet.**

ASSIGNMENT SHEET

INTRODUCTION TO SOIL, PLANT, AND CROP SCIENCE

A-1

Name ______________________ Score __________

OBJECTIVE 10 **Survey crops grown in your area.**

INSTRUCTIONS Survey two crops that are grown in your local or regional area. Answer the following questions about the crops.

Research and Reference
- Select useful resources
- Locate resources

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

1. What are the common and scientific names of the crops?

____

____

2. What are the primary uses of the crops?

____

____

3. Do the crops have any secondary uses?

____

____

4. What are the major markets for the crops?

____

____

5. **Briefly describe the production of the crops (planting, harvesting, etc.).**

____

____

____

____

____

____

OBJECTIVE SHEET

SAFETY

A-2

INTRODUCTION

Safety is a primary concern when working in agriculture. A knowledge and understanding of proper safety practices is vital. The potential for accidents in agriculture is high because of the use of chemicals and equipment. Accidents can range from minor cuts to injuries which are fatal. Many accidents that occur are because of **human error**. The risk of an accident occurring can be reduced if proper safety precautions are always followed. Safety of the individual workers, surrounding populations, and animals must always be considered.

Always follow federal and state regulations when working with hazardous chemicals.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS

PREREADING:	Read OSU Fact Sheet No. F-9417, *Combine Operations: Safety* or OSU Fact Sheet No. F-9420, *Tractor Upsets – Cause and Prevention.*
WRITING:	Write a short essay (one page) on the importance of following safety precautions for the particular fact sheet. Include a discussion of what may happen if proper safety procedures are not followed.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheets and by scoring 100% on the Written Test.

SPECIFIC OBJECTIVES

1. Describe the purpose of a Material Safety Data Sheet.
2. Define acute and chronic toxicity.
3. Define oral, dermal, and inhalation toxicity.
4. List symptoms of pesticide poisoning.
5. Choose the word or phrase to complete statements about chemical safety precautions.
6. Complete statements about the importance of protective clothing and equipment.
7. Select from a list true statements concerning chemical storage.
8. Choose correct methods of hazardous waste disposal.
9. Discuss labeling of hazardous materials.
10. Choose the word or phrase to complete statements about chemical use and groundwater protection.
11. List hand tool safety precautions and procedures.
12. List power tool safety precautions and procedures.
13. Complete statements concerning safety around large equipment.
14. Pass a chemical safety test with a score of 100%. (Assignment Sheet 1)
15. Interpret an MSDS. (Assignment Sheet 2)

INFORMATION SHEET

SAFETY

A-2

OBJECTIVE 1

Optional Activities/
Resources in
Instructor's Guide

Describe the purpose of a Material Safety Data Sheet.

WORDS YOU SHOULD KNOW	
carcinogen	a substance or agent that tends to produce cancer
health hazards	any substance which poses a threat to the health of an individual; examples are chemicals which are carcinogens, irritants, and substances which damage the lungs, skin, eyes, or mucous membranes
physical hazards	any substance which poses a threat to the safety of an individual; examples are compressed gas, explosive, flammable, or reactive substances

- The Material Safety Data Sheet (MSDS) supplies information about the characteristics of the hazardous chemical, the physical and health hazards associated with the chemical, precautions for safe handling and use of the chemical, and other information.

  EXAMPLE: If the chemical is a carcinogen

- The MSDS is used to find out about the physical and health hazards of working with the chemical before you work with it. The MSDS will tell you how to handle and use the hazardous chemical safely.

  ☑ **NOTE:** Chemical manufacturers and importers must obtain or develop an MSDS for each hazardous chemical that they produce or import. Employers must have a MSDS for each hazardous chemical that they use.

OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

Define acute and chronic toxicity.

WORDS YOU SHOULD KNOW	
toxicity	the ability of a substance to produce adverse effects; effects may range from minor symptoms such as a headache to severe symptoms such as convulsions or even death

☑ **NOTE:** The combination of acute toxicity and chronic toxicity is extremely dangerous. Limited daily exposure (chronic toxicity) will reduce the body's ability to cope with an acute toxicity.

- **Acute toxicity** results from a single incident of exposure to a substance. Symptoms of acute toxicity usually begin quickly. Acute toxicity can result from accidents such as:
    - ☐ splashing or spraying a pesticide onto a person
    - ☐ swallowing a pesticide
    - ☐ splashing a pesticide into the mouth
    - ☐ working around equipment that is faulty or broken

  ☑ **NOTE:** A substance that has a high acute toxicity can be fatal whenever a very small amount is absorbed.

- **Chronic toxicity** results from repeated exposure to pesticides over a period of time. Symptoms of chronic toxicity may take a long time to become noticed but can lead to serious illness. Chronic exposure occurs because of:
    - ☐ inadequate or faulty protective clothing and equipment
    - ☐ improper cleanup procedures
    - ☐ unsafe working conditions
    - ☐ reentry into areas before it is safe

  ☑ **NOTE:** Some of the major adverse effects of chronic toxicity include carcinogenesis, the production of tumors (cancer); teratogenesis, the production of birth defects; mutagenesis, the production of changes in genetic structure; and effects on the reproductive system.

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

Define oral, dermal, and inhalation toxicity.

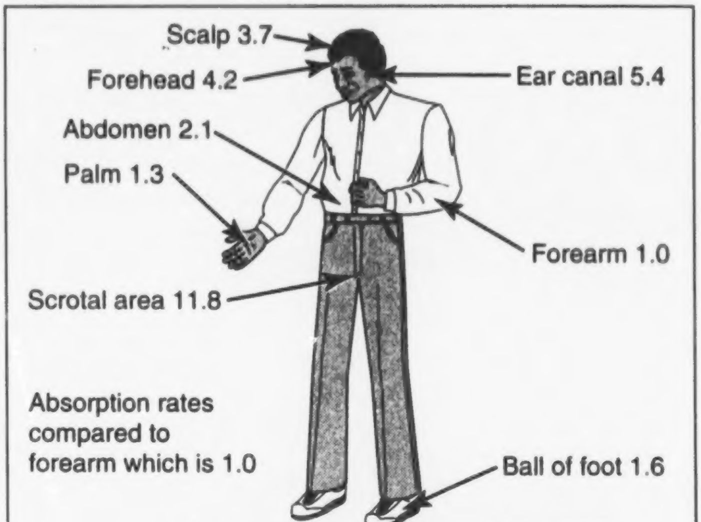
- **Oral toxicity (swallowing)** – toxicity which occurs when hazardous substances enter through the mouth

  ☑ **NOTE:** Oral toxicity can occur through improper sanitation such as not washing hands before eating or drinking; smoking; accidently ingesting pesticide by confusing it with food or drink; contamination of food by pesticides; accidently splashing pesticide into the mouth.

- **Dermal toxicity (contact with skin)** – toxicity which occurs when hazardous substances enter through the skin and eyes (skin contamination)

  ☑ **NOTE:** Dermal toxicity can occur by not properly washing hands after using pesticides; wearing improper or faulty protective clothing and equipment; splashing or spraying pesticides on skin or eyes which are unprotected; wearing clothing that is contaminated; and applying pesticides when the weather is windy. Figure 1 lists absorption rates of different areas of the body.

FIGURE 1



Absorption rates compared to forearm which is 1.0

Comparative rates of dermal absorption for different parts of the body.

- **Inhalation toxicity (breathing)** – toxicity which occurs when hazardous substances enter through the lungs

  ☑ **NOTE:** Inhalation toxicity can occur through breathing vapors, fumes, dust, or mist from hazardous substances and from improper use or faulty equipment on a respirator.

OBJECTIVE 4

Optional Activities/ Resources in Instructor's Guide

List symptoms of pesticide poisoning.

WORDS YOU SHOULD KNOW

external irritant	pesticide poisoning which causes redness, blisters, and rashes on the skin, and swelling or irritation in the eyes, nose, mouth, and throat
internal poisons	pesticide poisoning which injures organs or other systems inside the body

☑ **NOTE:** Symptoms of pesticide poisoning are extremely varied and will depend on the chemical, amount, and length of exposure. Effects range from minimal for low toxicity chemicals to fatal for highly toxic chemicals. Labels of highly toxic substances will often list poisoning symptoms on the label. Read the label and be aware of symptoms to watch for. The following list is only a guide. Many of the symptoms are similar to common illnesses such as the flu. If you develop symptoms after working around a pesticide, call Emergency Medical Services (EMS) or a poison control center **immediately**.

- Redness, blisters, or a rash on the skin
- Irritating sensations or swelling in the eyes, nose, mouth, or throat
- Headaches
- Dizziness
- Weakness
- Nausea
- Stomach cramps
- Diarrhea

- Sweating
- Shaking
- Excitability
- Disorientation
- Excessive sweating
- Vomiting
- Thirst
- Convulsions
- Irritation of the lungs
- Lack of coordination
- Discoloration of urine/blood in the urine
- Garlic odor on breath
- Chills
- Cough
- Discolored skin
- Shortness of breath
- Shock
- Muscle twitching
- Salivation

OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Choose the word or phrase to complete statements about chemical safety precautions.

- READ AND FOLLOW all label directions carefully. Properly identify the reason for using chemicals.

  ☑ **NOTE:** Read the label directions before using any chemical. If unsure of the pesticide to use, seek the advice of an expert.

- Always wear the appropriate protective clothing and equipment. Properly clean contaminated clothing. If pesticides are splashed or spilled on the skin or clothing, remove the clothing at once and wash the skin thoroughly with soap and water.

- Do NOT use equipment that is faulty.

  EXAMPLE: Sprayers with leaking hoses or connections

- Do NOT eat, drink, or smoke while handling pesticides.

- Do NOT work alone when using highly toxic pesticides.

- Mix pesticides in an open area where there is adequate ventilation.

  ☑ **NOTE:** Pesticides should never be mixed in an enclosed area.

- Keep livestock, pets, and unauthorized individuals out of areas of mixing, loading, and application.

- Pesticides should not be applied during or just before expected high winds or heavy rain or directly into the wind.

  ☑ **NOTE:** Do NOT allow pesticides to drift onto neighboring fields.

- Do NOT contaminate bodies of water with pesticides.

  EXAMPLE: Ponds, streams, lakes

- Dispose of empty containers promptly, safely, and according to the law.

- If symptoms of poisoning appear during or shortly after handling pesticides, **immediately** seek medical attention.

  ☑ **NOTE:** Be prepared to tell medical personnel the type of pesticide used. Take the pesticide label or labeled container with you. Work areas must have eye wash and shower facilities.

OBJECTIVE 6

Optional Activities/
Resources in
Instructor's Guide

Complete statements about the importance of protective clothing and equipment.

☑ **NOTE:** Proper protective clothing and equipment must be used when handling, mixing, and applying pesticides.

- Properly using protective clothing and equipment will prevent pesticides from entering your body.
- At the minimum wear long-sleeved shirts and long-legged trousers or a coverall garment.

  ☑ **NOTE:** If handling pesticides that are highly toxic or if there is a possibility that the clothing might become wet, such as from mist, wear water-repellent garments such as a rubber apron.

- Always wear gloves that are liquid-proof rubber, vinyl, or plastic when handling pesticides.

  ☑ **NOTE:** Do NOT wear leather gloves or gloves that are lined with a fabric. Leather and fabric will absorb pesticides. Gloves should extend far enough down to protect the wrists.

- Wear a wide-brimmed water-repellent hat to protect your head and neck.
- Wear boots that are chemical-resistent such as neoprene or rubber boots.

- Wear goggles or a face shield to protect your eyes, when needed.

- Check the label on fumigants for appropriate protective clothing.

  ☑ **NOTE:** Some fumigants can easily penetrate some types of protective clothing.

- Wear a respirator, if necessary.

  ☑ **NOTE:** A respirator must be worn if there is the possibility that chemical dust or vapors could be inhaled. Use an appropriate respirator for the particular chemical being used.

- Clean protective clothing and equipment thoroughly.

  ☑ **NOTE:** Protective clothing requires special considerations when cleaning. For example, protective clothing must be washed separately from other laundry.

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

Select from a list true statements concerning chemical storage.

- READ AND FOLLOW label instructions for storage.

- Store pesticides in their original, closed, labeled containers.

- Do NOT store pesticides near food, feed, seed, or animals.

  ☑ **NOTE:** Pesticides must always be kept separate from feed and livestock. A pesticide storage location should not be later used to store feed or as animal shelter since total decontamination is not possible.

- Store pesticides in a safe area that is cool, dry, well-ventilated, lighted, out of direct sunlight, and insulated to prevent freezing or overheating.

  ☑ **NOTE:** Some pesticides require special protection against freezing or extreme heat; read the label for precautions.

- Store pesticides in a fireproof area that has a cement floor.

- Store pesticides that come packaged in paper containers off of the floor.
- Keep the storage area locked to avoid entry by unauthorized persons.
- Post warning signs on the doors and windows of the storage area.
- Store pesticides in a storage building away from areas where people or animals live.
- Keep a current inventory of the pesticides.

  ☑ **NOTE:** Pesticide containers should be tagged or marked with the date of purchase when they are delivered to the storage area. If possible purchase only the amount of pesticide needed for the season. If a large inventory must be maintained, use older pesticides first.

- Supply the storage area with appropriate materials for cleaning up spills.
- Keep an appropriate fire extinguisher available.

  ☑ **NOTE:** The fire extinguisher should be rated for ABC fires.

- Check pesticide containers for leaks.

  ☑ **NOTE:** If a pesticide container is leaking, transfer the contents to a container that has held exactly the same pesticide.

- Do not store pesticides in the sun or near other sources of heat.

  ☑ **NOTE:** Being stored in the sun or near heat, such as steam pipes, can cause liquids to expand and the contents of the container to be under pressure. Some pesticides may also be flammable if overheated and others may break down and lose their potency.

- If large quantities of pesticides are stored on site, notify the local fire department of the location, amounts, and types of pesticides.

OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

Choose correct methods of hazardous waste disposal.

☑ **NOTE:** Always follow federal and state laws regarding disposal of hazardous wastes.

- Take excess pesticides to a landfill operating under the Environmental Protection Agency (EPA) or a state permit for pesticide disposal.

  ☑ **NOTE:** Many solid waste landfills are not suitable for hazardous waste disposal. Check with the state agency responsible for hazardous waste or the EPA for the location of approved landfills.

- If you cannot dispose of empty containers or excess pesticides right away, keep them in a locked storage area until they can be properly disposed of.

- Triple rinse empty containers and dispose of them in a sanitary landfill.

  ☑ **NOTE:** Follow the steps below to triple rinse containers.

  1. Empty the container into the spray tank and let it drain for 30 seconds.
  2. Fill the container one-fifth to one-fourth full of water.
  3. Thoroughly rinse the container three times, pouring the water into the tank and draining vertically for 30 seconds.
  4. Properly dispose of the container.

- Empty containers that have not been triple rinsed must be disposed of at a landfill operating under the EPA or a state permit for pesticide disposal.

- Large containers may be able to be reused by the supplier or a firm that deals in reconditioned drums.

- Some containers may be able to be recycled as scrap metal.

☑ **NOTE:** Never reuse empty containers. Do not reuse containers to handle feed or water for animals.

OBJECTIVE 9

Optional Activities/
Resources in
Instructor's Guide

Discuss labeling of hazardous materials.

WORDS YOU SHOULD KNOW	
label	the information that is printed on or attached to the container
labeling	includes all of the information that is received from the manufacturer of the product; may include items such as brochures and leaflets

- Hazardous materials must be labeled for the following reasons:
    - Required by law

      ☑ **NOTE:** Labels and other forms of warning are required by 29 CFR 1910.1200(f)

    - Identifies containers of hazardous chemicals

      ☑ **NOTE:** A "container" is any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or any other item that contains a hazardous chemical.

    - Warns about the hazards of a hazardous chemical
    - Gives the name and address of the responsible party

      EXAMPLES: Chemical manufacturer, importer

- Employer responsibilities for labeling include:
    - Ensure that each container of hazardous chemicals in the workplace is labeled, tagged or marked with 1) the identify of the hazardous chemical(s) in the container and 2) appropriate hazard warnings.
    - Not to remove or deface existing labels on incoming containers of hazardous chemicals.

- ☐ Ensure that labels or other forms of warning are legible, in English, and prominently displayed on the container, or readily available in the work area throughout each work shift

  ☑ **NOTE:** Employers having employees who speak other languages may add the information in their language to the material presented, as long as the information is also presented in English.

- ☐ Follow all applicable standards and OSHA guidelines.

- Guidelines for hazardous materials labels include:
  - ☐ Label, tag, or mark all containers of hazardous materials.
  - ☐ Warn against specific hazards.
  - ☐ Replace hard-to-read labels.
  - ☐ Follow all labeling requirements of any substance-specific health standard that applies to any hazardous chemical.

OBJECTIVE 10

Optional Activities/
Resources in
Instructor's Guide

Choose the word or phrase to complete statements about chemical use and groundwater protection.

WORDS YOU SHOULD KNOW	
groundwater	water which is beneath the surface of the ground that is the supply for spring and well water

- Groundwater is a vital natural resource. Many people depend on groundwater as a source of drinking water and also as a source for irrigating agricultural crops.

  ☑ **NOTE:** Approximately one-half of the people in the United States and up to 90% of rural populations depend on groundwater as a source of drinking water.

- Concern about the quality of and possible contamination of groundwater has focused national efforts on groundwater protection.

- Chemicals used on the surface of the earth, such as pesticides, can move down through the soil and reach the groundwater.

- The major factors which determine whether chemicals will reach the groundwater are:
    - characteristics and application method of the chemical
    - type of soil
    - the amount and timing of surface water such as rain or irrigation
    - depth of the groundwater
    - geological formations above the groundwater

  ☑ **NOTE:** These factors work together in a complex manner to bring about the conditions necessary for chemicals to reach the groundwater.

- Methods for control of pests should be chosen for their ability to achieve effective, practical, economical, and environmentally sound control.

- Follow the directions on the label carefully and use well-planned irrigation schedules to minimize the risk of groundwater contamination.

- Although chemicals are an important component of pest management, other methods of control such as integrated pest management programs are often appropriate.

OBJECTIVE 11

Optional Activities/
Resources in
Instructor's Guide

List hand tool safety precautions and procedures.

- Use the right tool for the job.
- Keep sharp tools sharp.
- Keep tools clean.
- Inspect tools often and repair or replace damaged or broken tools before using them again.
- Pay attention at all times.

  ☑ **NOTE:** Human failure is a primary cause of accidents.

- Wear the right kind of personal protective equipment, when needed.
- Store all tools properly when not in use.
- Use appropriate tool boxes, tool chests, and cabinets for storage.
- While you are using tools, store them properly.

  EXAMPLE: Lay down a handsaw flat on a table, to protect the saw teeth from being bent. Also use the right type of carrying belt, pouch, or other method of storing tools while you are using them.

- Guard the sharp edges of tools in storage and on-the-job.

  EXAMPLE: Some tools may have their own carrying case to guard pointed or sharp edges, handsaws often have guards that slide over the saw teeth, etc.

OBJECTIVE 12

Optional Activities/
Resources in
Instructor's Guide

List power tool safety precautions and procedures.

- Use the right tool for the job.
- Know how to use the tool correctly before using any power tool.
- Ground all power tools before using them.
- Replace any damaged or worn parts and power cords before using a tool.
- Make sure all equipment is in OFF position before plugging in the equipment.
- Remove keys and adjusting wrenches before starting the tool.
- Wear the proper type of protective clothing and equipment.
- Keep your hands and clothing away from any moving parts of the tool at all times.

  EXAMPLE: Keep shirts tucked in and hair pulled back.
- Do NOT use a power tool on or near a wet surface.
- Turn off and unplug the tool before adjusting or changing any attachments.
- Store the tool properly after using it.
- Never leave a running tool unattended.
- Remove any jewelry before using a power tool.

OBJECTIVE 13 **Complete statements concerning safety around large equipment.**

Optional Activities/
Resources in
Instructor's Guide

- Know how to properly operate equipment.
- Always follow manufacturer's instructions and safety practices.
- Pay attention at all times when around or operating equipment.
- Shut off the equipment before making **any** repair or adjustment.
- Inspect equipment for missing or damaged safety guards and signs. Repair or replace missing or damaged guards or signs. Do NOT operate equipment that is missing guards.
- Do NOT wear loose, baggy clothing or jewelry that may catch on equipment.

  ☑ **NOTE:** Long hair should be pulled back.

- Be aware of potential hazards involved with equipment you are operating or working around.

  EXAMPLE: Entrapment in a grain bin

- Make sure that power takeoff drive lines (shafts) are fully shielded.

  ☑ **NOTE:** Accidents around power takeoff drive lines are among the most common equipment hazards. Exposed parts can easily catch on clothing and result in entanglement.

- Remain at a safe distance from rotating power takeoff lines.

OBJECTIVE 14 **Complete Assignment Sheet 1.**

OBJECTIVE 15 **Complete Assignment Sheet 2.**

ASSIGNMENT SHEET 1

SAFETY

A-2

Name ________________________________ Score __________

OBJECTIVE 14

Pass a chemical safety test with a score of 100%.

INSTRUCTIONS

Cognitive Activities
- Analyze/synthesize information
- Draw conclusions

Answer the following questions by placing the correct letters in the blanks. "T" for true and "F" for false.

_____ 1. Employers are only required to keep MSDSs for hazardous chemicals if employees request them to be kept.

_____ 2. Chronic toxicity results from repeated exposures to pesticides over a period of time.

_____ 3. Symptoms of acute toxicity usually develop over time.

_____ 4. Dermal toxicity occurs when hazardous substances enter through the skin and eyes.

_____ 5. Symptoms of pesticide poisoning are varied and may be similar to common illnesses such as the flu.

_____ 6. Symptoms of pesticide poisoning are very specific and difficult to mistake for anything else.

_____ 7. Wear only protective clothing and equipment which is very comfortable.

_____ 8. Read and follow all label directions carefully.

_____ 9. Use the most inexpensive pesticide available.

_____ 10. Apply pesticides when it is most convenient for you.

_____ 11. Wear gloves while eating or drinking around pesticides.

_____ 12. Dispose of empty containers promptly, safely, and according to the law.

_____ 13. Mix pesticides in an enclosed area so that you have more control over the mixing.

_____ 14. Use equipment until it becomes a severe safety hazard.

_____ 15. Do NOT contaminate bodies of water with pesticides.

_____ 16. Always wear gloves that are liquid-proof rubber, vinyl, or plastic when handling pesticides.

_____ 17. Do not wear a hat because it might impair your vision while working with pesticides.

_____ 18. Store pesticides in their original, closed, labeled containers.

_____ 19. Pesticides may be stored with feed or seed if the containers are clearly labeled.

_____ 20. Excess pesticides may be thrown away with regular garbage.

_____ 21. Employers must not remove or deface existing labels on containers of hazardous chemicals.

_____ 22. Groundwater contamination is not a concern when using pesticides.

_____ 23. Use the right tool for the job.

_____ 24. Inspect tools only once a year.

_____ 25. If only making minor adjustments or repairs to a power tool or equipment, it is not necessary to turn off and unplug the tool.

_____ 26. Baggy clothing is the best choice to wear because it is the most comfortable when working with power tools or large equipment.

_____ 27. Make sure that power takeoff drive lines (shafts) are fully shielded.

_____ 28. Always follow manufacturer's instructions and safety practices.

_____ 29. Always follow federal and state laws when working with pesticides.

_____ 30. Clean tools and equipment only once per year.

ASSIGNMENT SHEET 2 — SAFETY — A-2

Name ______________________________ Score __________

OBJECTIVE 15 **Interpret an MSDS.**

INSTRUCTIONS Using the MSDS on the following pages, answer the questions that follow.

Functional Reading
- Interpret forms and records
- Interpret abbreviations/acronyms

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Cognitive Activities
- Analyze/synthesize information
- Draw conclusions

Product Name(s): COMMAND® 4 EC HERBICIDE
COMMAND® 480 g/L EC HERBICIDE

MATERIAL SAFETY DATA SHEET

This document has been prepared to meet the requirements of the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200; the EU Directive, 91/155/EU and other regulatory requirements. The information contained herein is for the concentrate as packaged, unless otherwise noted.

1. Company and Product Identification

FMC CORPORATION
Agricultural Chemical Group
1735 Market Street
Philadelphia, PA 19103 U.S.A.

Code Number : 618
Active Ingredient : Clomazone
Chemical Family : Herbicide
Formula : $C_{12}H_{14}ClNO_2$ (clomazone)
Alternate Brand Names : Command 48 EC; Command 480 EC; Magister; Merit EC
Synonyms : FMC 57020; 2-(2-chlorophenyl) methyl-4,4-dimethyl-3-isoxazolidinone; IUPAC: 2-(2-chlorobenzyl)-4,4-dimethyl-1,2-oxazolidin-3-one; 2-(2-chlorobenzyl)-4,4-dimethylisoxazolidin-3-one

EMERGENCY TELEPHONE NUMBERS:

CHEMTREC
(800)424-9300 (U.S.A. & Canada)
(202)483-7616 (All Other Countries)

FMC CORPORATION
(800)331-3148 (U.S.A. & Canada)
(716)735-3765 (All Other Countries-*reverse charges*)

2. Composition/Information on Ingredients

Ingredient Name	CAS #	EU Number	PEL/TLV	EU Class
Clomazone (46.7%)	81777-89-1	None	None	None
Aromatic Hydrocarbon (<26%)	64742-95-6	650-001-00-0	100 ppm	None
1,2,4-trimethylbenzene (<13.1%)	95-63-6	None	25 ppm	None
Xylene (<8.2%)	1330-20-7	601-022-00-9	100 ppm 150 ppm STEL	R11-20/21-38
Surfactant Blend (<7%)	None	None	None	None
Ethylbenzene (<1.2%)	100-41-4	601-023-00-4	100 ppm 125 ppm STEL	R11-20
1-butanol (<1.2%)	71-36-3	603-004-00-6	50 ppm (skin)(ceiling)	R10-20
Cumene (<1%)	98-82-8	601-024-00-X	50 ppm (skin)	R10-37

3. Hazards Identification

Emergency Overview:

- Straw yellow liquid with an aromatic solvent odor.
- Moderately combustible. May support combustion if heated above the product's flash point (40°C/104°F).
- Thermal decomposition and burning may form toxic by-products.
- For large exposures or fire, wear personal protective equipment.
- Slightly to moderately toxic to fish and aquatic organisms. Keep out of drains and water courses.
- Moderately irritating to the eyes.

Potential Health Effects: Effects from overexposure result from either swallowing, inhaling or coming into contact with the skin or eyes. Symptoms of overexposure include decreased activity, tearing eyes, bleeding from the nose and incoordination.

Medical Conditions Aggravated by Exposure: None presently known.

4. First Aid Measures

Eyes : Flush with water for at least 15 minutes. If irritation occurs and persists, contact a medical doctor.
Skin : Wash with plenty of soap and water. Get medical attention, if irritation occurs and persists.
Inhalation : Remove to fresh air. If breathing difficulty or discomfort occurs and persists, contact a medical doctor.
Ingestion : Rinse mouth with water. Dilute by giving 1 or 2 glasses of water. Do not induce vomiting. Never give anything by mouth to an unconscious person. See a medical doctor immediately.

Note to Medical Doctor : This product has low oral, dermal and inhalation toxicity. It is moderately irritating to the eyes and slightly irritating to the skin. Direct contact with eyes may produce corneal damage, especially if not washed out immediately. Inert ingredients contain xylene-range aromatic solvents which may produce a chemical pneumonitis; therefore, vomiting is not recommended, and lavage requires intubation. Activated charcoal and cathartics will assist gastrointestinal tract evacuation.

5. Fire Fighting Measures

Flash Point : 40°C (104°F) (TCC)
Extinguishing Media : Foam, CO_2 or dry chemical. Soft stream water fog only if necessary. Contain all runoff.
Degree of Fire/Explosion Hazard : Moderately combustible. When heated above the flash point, this product releases vapors which, when mixed with air, can burn or be explosive.
Special Fire Fighting Procedures : Isolate fire area. Evacuate downwind. Wear full protective clothing and self-contained breathing apparatus. Do not breathe smoke, gases or vapor generated.
Hazardous Decomposition Products : Carbon monoxide, carbon dioxide, oxides of nitrogen, chlorine, and hydrogen chloride.

6. Accidental Release Measures

Isolate and post spill area. Wear protective clothing and personal protective equipment as prescribed in Section 8, "Exposure Controls/Personal Protection". Keep unprotected persons and animals out of the area.

Keep material out of streams and sewers. Dike to confine spill and absorb with an absorbent such as clay, sand or soil. Vacuum, shovel or pump wastes into a drum and label contents.

To clean and neutralize tools and equipment wash with a suitable solution (i.e., 20% solution of potassium hydroxide in methanol). Follow by washing with strong soap and rinsing with water, and add both solution to the drums of waste already collected. *To clean and neutralize spill areas,* spray the area with a 20% solution of potassium hydroxide in methanol. Cover the treated area with plastic and let stand for 24 hours. Remove the covering and place in a drum for later disposal. Wash the area with a strong soap, three times, and rinse with water. If spill occurs on a wooden surface, repeat the entire process again. Absorb, as above, any excess liquid and add to the drums of waste already collected. Dispose of drummed waste according to the method outlined in Section 13, "Disposal Considerations".

7. Handling and Storage

Store in a cool, dry, well-ventilated place. Do not use or store near heat, open flame or hot surfaces. Store in original containers only. Keep out of reach of children and animals. Do not contaminate other pesticides, fertilizers, water, food or feed by storage or disposal.

8. Exposure Controls/Personal Protection

Personal protective recommendations for mixing or applying this product are prescribed on the product label. Information stated below provides useful, additional guidance for individuals whose use or handling of this product is not guided by the product label.

Ventilation : Use local exhaust at all process locations where vapor or mist may be emitted. Ventilate all transport vehicles prior to unloading.
Work Clothing : Depending upon concentrations encountered, wear coveralls or long-sleeved uniform and head covering. For larger exposures as in the case of spills, wear full body cover barrier suit, such as a rubber rain suit. Leather items - such as shoes, belts and watchbands - that become contaminated should be removed and destroyed. Launder all work clothing before reuse (separately from household laundry).

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8. Exposure Controls/Personal Protection (cont'd)

Eye Protection : For splash, mist or vapor exposure, wear chemical protective goggles or a face shield.

Respiratory Prot. : For splash, mist or vapor exposure wear, as a minimum, a properly fitted half-face or full-face air-purifying respirator which is approved for pesticides (U.S. NIOSH/MSHA, EU CEN or comparable certification organization). Respirator use and selection must be based on airborne concentrations.

Gloves : Wear chemical protective gloves made of materials such as neoprene. Thoroughly wash the outside of gloves with soap and water prior to removal. Inspect regularly for leaks.

Personal Hygiene : Clean water should be available for washing in case of eye or skin contamination. Wash skin prior to eating, drinking or using tobacco. Shower at the end of the workday.

9. Physical/Chemical Properties

Appearance : Straw yellow liquid
Odor : Aromatic solvent
Specific Gravity : 1.021 - 1.024 (water = 1)
Solubility (H_2O) : Emulsifies
Molecular Weight : 239.7 (clomazone)
Flash Point : 40°C (104°F)
Weight per Volume : 8.57 lb/gal. (1021 - 1024 g/L)

10. Stability and Reactivity

Stability : Stable
Hazardous Polymerization : Will not occur
Conditions/Materials to Avoid (Incompatibility) : Excessive heat and fire.

11. Toxicological Information

Rat Acute Oral : LD50 = 1406 mg/kg
Rabbit Acute Dermal : LD50 > 2000 mg/kg
Rat Acute Inhalation : LC50 = 4.47 mg/L/4 hr

Acute Effects From Overexposure : This product has low oral, dermal and inhalation toxicity. It is moderately irritating to the eyes and slightly irritating to the skin. Large doses of clomazone ingested by laboratory animals produced signs of toxicity including ataxia, decreased activity, lacrimation, bloody tears, oral discharge and bloody nasal discharges. Inhalation of aromatic hydrocarbon vapors may cause dizziness, disturbances in vision, drowsiness, respiratory irritation, and eye, skin and mucous membrane irritation. Vomiting after ingestion of this product may cause aspiration of aromatic hydrocarbons into the lungs which may result in fatal pulmonary edema. Exposure to butanol vapors may produce headaches, drowsiness and irritation of the nose and throat. Excessive exposures to butanol liquid or vapors may result in contact dermatitis and irritation of the mucous membranes.

Chronic Effects From Overexposure : No data available for this product. In studies with laboratory animals, clomazone did not cause reproductive toxicity, teratogenicity or carcinogenicity. Liver enlargement and elevated cholesterol levels are often noted in laboratory animals that have ingested large doses of clomazone during their lifespan. An overall absence of genotoxicity has been demonstrated in tests of mutagenicity, DNA damage and chromosome aberrations. Chronic exposure to aromatic hydrocarbons may cause headaches, dizziness, loss of sensations or feelings, and liver and kidney damage. Inhalation of xylene vapors at high doses has also resulted in an increase incidence of malformations and decreases in fetal weight in laboratory animals. Damage from xylene may be potentiated by alcohol. Disturbances in hearing and balance have been reported in workers exposed to butanol vapors.

Carcinogenicity: **IARC:** No **NTP:** No **Other** (OSHA): No

12. Environmental Information

The information presented below is for the active ingredient, clomazone.

Physical/Environmental Properties :

Clomazone has a moderate rate of degradation in soil (half-life = 24 days), and is stable to hydrolysis over a wide range of pH. The bioconcentration potential for clomazone is low, with a Log P_{OW} of 2.5, and a measured bioconcentration factor (BCF) of 27 - 40. Field studies showed that clomazone does not significantly leach below 15 cm in soil and is, therefore, not expected to enter groundwater.

12. Environmental Information (cont'd)

Environmental Toxicology :

Clomazone ranges from highly to moderately toxic to aquatic organisms, having LC50 values from 0.57 to 34 mg/L. Care should be taken to avoid contamination of the aquatic environment. Clomazone is of low toxicity to both waterfowl and upland game birds, with oral LD50 values <2,510 mg/kg and dietary LC50 values in excess of 5,620 ppm.

13. Disposal Considerations

Open dumping or burning of this pesticide or its packaging is prohibited. If spilled material cannot be disposed of by use according to label instructions, an acceptable method of disposal is to incinerate in accordance with local, state and national laws and regulations. However, because acceptable methods of disposal may vary by location, and regulatory requirements may change, the appropriate regulatory agencies should be contacted prior to disposal.

Non-returnable containers which held these pesticides should be cleaned, prior to disposal, by triple-rinsing. Containers which held this material may be cleaned by being triple-rinsed, and recycled, with the rinsate being incinerated. Do not cut or weld metal containers. Vapors that form may create an explosion hazard.

14. Transportation Information

For highway and railroad shipment in the U.S.A.: Compound, weed killing (herbicides), NOI. NMFC Item 50320.

For air and water shipment, and also raod and rail other than in the U.S.A.: Flammable liquids, n.o.s. (contains xylene), 3, UN1993, III. ERG Guide 27.

MARPOL Designation: Not listed. **Reportable Quantity:** Not listed.

Compound, weed killing (herbicides), NOI. NMFC Item 50320. Command® 4 EC/Command® 480 g/L EC.

15. Regulatory Information

Australian Hazard Code : 3XE

U.S. CERCLA Reportable Quantity (RQ) : This product contains the following ingredients listed in 40 CFR Table 302.4:

	Percentage by weight	Final RQ (lb.)
xylene, mixed isomers	< 8.2	1,000
ethylbenzene	< 1.2	1,000
1-butanol	< 1.2	5,000
cumene	< 1.0	5,000

U.S. EPA Signal Word : WARNING

U.S. SARA Title III

Section 302 Extremely Hazardous Substances	(40 CFR 355)	: Not Listed
Section 302.4 Reportable Quantity (RQ)	(40 CFR 355)	: Not Listed
Section 311 Hazard Categories	(40 CFR 370)	: Immediate, Delayed, Fire
Section 312 Threshold Planning Quantity	(40 CFR 370)	: The threshold planning quantity (TPQ) for this product, if treated as a mixture, is 10,000 lb. This product contains the following ingredients with a TPQ of less than 10,000 lb.: None.

Section 313 (40 CFR 372) : This product contains the following ingredients subject to Section 313 reporting requirements: 1,2,4-trimethylbenzene (<13.1%); xylene, mixed isomers (<8.2%); ethylbenzene (<1.2%); and 1-butanol (<1.2%).

Courtesy of FMC Corporation.

1. What is the emergency number of the manufacturer (U.S.A. & Canada)?

2. What is the product name(s)?

3. What is the active ingredient in the product?

4. What is the appearance and odor of the product?

5. How combustible is this product?

6. What are the symptoms of overexposure?

7. What emergency and first aid procedures are listed in the MSDS for eyes and for ingestion?

8. What type of eye protection and gloves should be worn?

9. How toxic is this product to aquatic organisms?

10. What conditions/materials should be avoided with this product?

OBJECTIVE SHEET

CAREERS

A-3

INTRODUCTION

Because of the decrease in the number of farms and ranches it might appear that the career opportunities in agriculture are also decreasing. But just the opposite is true. Although there are fewer farms and ranches, their size and complexity are increasing. Agriculture is a field which affects every person and is related to many other industries. There will continue to be a demand for employees with strong educational training in the agricultural field. Careers in crop science include opportunities in areas such as agribusiness, education, and research.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS	
PREREADING:	Read the Handout *Careers in Crop Science.*
WRITING:	Write a short (one paragraph to one page) essay describing what you believe would be advantages and disadvantages to the three jobs described.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Discuss employment opportunities at various educational levels.
2. Compare degree requirements in crop science from two colleges or universities. (Assignment Sheet 1)
3. Compare salaries and benefits in various careers. (Assignment Sheet 2)
4. Determine areas of study/specialization in crop science.
5. Evaluate requirements for a career in crop science.
6. Interview someone in the crop science industry. (Assignment Sheet 3)
7. Name organizations that employ people trained in crop science.
8. Identify organizations involved in production, sales, or services of crops in your community, county, or area. (Assignment Sheet 4)
9. Outline a presentation on crop science careers. (Assignment Sheet 5)
10. Give a presentation on a career in crop science. (Assignment Sheet 6)

INFORMATION SHEET

CAREERS

A-3

OBJECTIVE 1

Optional Activities/
Resources in
Instructor's Guide

Discuss employment opportunities at various educational levels.

WORDS YOU SHOULD KNOW

career	a chosen pursuit; a field of interest
job	a position in which one is employed
profession	a particular occupation, especially one that requires specialized education

Almost all jobs in the wide range of employment opportunities in crop science are related to educational level and job experience. Jobs in the crop science field for various educational levels are often related. For example, you might start your career working at an entry-level position (high-school education) as a stocker for a feed company and later receive a bachelor's degree and move into a management position.

- No matter what educational level you attain there are certain skills and steps that you can take that will make you a more desirable employee.
    - ☐ Obtain related experience through clubs and organizations.

      EXAMPLES: FFA, 4-H
    - ☐ Have work experience.

      EXAMPLES: Summer jobs, part-time jobs, internships
    - ☐ Know how to use computers.

      ☑ **NOTE:** Computers are becoming common in all areas of business. Computer competency is becoming a necessity: computer education will enhance your ability to obtain desirable positions.

☐ Assess your interests and skills.

☑ **NOTE:** You should consider what types of positions are suited to your interests and skills. For example, if you enjoy working outdoors you might consider a career as a range management specialist. If you are interested in conservation, a career as a soil conservationist would be a good choice.

- **High school education** – A high school education enables you to learn basic skills on the job in an entry level position.

  EXAMPLES: Farm worker, clerical worker

- **Two-year associate degree or vocational training** – A two-year associate degree or vocational training enables you to enter a profession at a higher level than you could with a high school education. There is greater possibility for advancement.

  EXAMPLES: Plant care worker, forest technician, computer operator

- **Four-year college degree** – A four-year college degree enables you to enter the work force at a professional level with a high degree of career advancement possibility.

  EXAMPLES: Agricultural education teacher, farm manager, crop marketing specialist, farm magazine writer, soil surveyor, range management specialist

- **Advanced college degree** – An advanced college degree enables you to become a professor, a researcher, or other specialist.

  EXAMPLES: Plant biochemist, environmental scientist, erosion and sediment control specialist, college professor, chemist

OBJECTIVE 2 **Complete Assignment Sheet 1.**

OBJECTIVE 3 **Complete Assignment Sheet 2.**

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Determine areas of study/specialization in crop science.

Categories of crop science careers include:

- **Production** – Careers in production require solid knowledge of agronomy, soil science, and business. The production industry is the foundation of the crop science industry.
- **Science** – Careers in science require a strong education in the scientific method, chemistry, nutrition, biology, and communication. Scientific research has increased efficiency and improved crop quality.
- **Agribusiness** – Careers in agribusiness require a basic knowledge of crop science along with comprehension and skills in business, advertising, economics, computer science, and effective communications.
- **Agricultural sales** – Careers in agricultural sales require a basic knowledge of agriculture and a desire to be of service, along with skills in sales, business, marketing, advertising, computer use, and effective communications.
- **Food industry** – The food industry offers many opportunities in processing, packaging, and distributing food that is nutritious, safe, convenient, attractive, and economical. Careers require a basic knowledge of crop science along with comprehension of marketing, advertising, sales, processing, economics, and computer science.
- **Education** – Opportunities in education are available at all levels. Public education requires certification, while private schools are able to hire non-certified teachers. Careers require a broad knowledge of agriculture, teaching skills, and a commitment to helping young people learn and develop.
- **Public sector** – The federal government, the state government, and local counties hire employees with degrees in crop science for extension services, research, conservation, and many more.
- **International** – International opportunities are also plentiful. The global agricultural community will have to address the nutritional needs of the growing global community. Careers require a fundamental knowledge of agriculture in addition to economics, business, banking, trade, and language.

OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Evaluate requirements for a career in crop science.

- **Education and training** -- Includes both formal education (in the classroom) and skills learned during on-the-job training.

  ☑ **NOTE:** Both types of education are important for a successful career. Classroom training provides a foundation for applying practical skills to the workplace. Careers in crop science require a strong scientific background. The level of education and training required depends on the specific career and may range from a high school education to an advanced college degree.

- **Communication and human relations skills** – Oral and written communications are important in all career areas. Human relations skills include the ability to work with others and solve conflicts in a positive manner.

  ☑ **NOTE:** Jobs are often lost not because individuals do not have the skills to perform the job but because they lack the human relations skills necessary to work with others.

- **Dependability and dedication** – Dependability and dedication are important in all career areas. Dependability includes being on time every day to the job, observing safety practices, and being able to take responsibility. Dedication enables you to demonstrate your desire to work in the career.

- **Professionalism** – Professionalism is a broad concept that includes such items as acting appropriately, dressing appropriately, using appropriate language, and following ethical business practices.

☑ **NOTE:** It is also important to obtain the skills necessary for gaining employment. These skills include assessing your job skills, writing a resume, searching for a position, applying for a position, interviewing, following up with correspondence, and accepting and starting a job.

OBJECTIVE 6

Complete Assignment Sheet 3.

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

Name organizations that employ people trained in crop science.

WORDS YOU SHOULD KNOW	
lobbyist	a person employed to influence legislators to introduce or to vote for measures favorable to the interest he or she represents

Both public and private organizations employ people trained in crop science. Jobs include those that are directly related to the production of crops, such as owner of a custom combine operation, and those indirectly related to the production of crops, such as feed sales.

- Federal agencies

  EXAMPLES: USDA, Natural Resources Conservation Service, Forest Service

- State agencies

  EXAMPLE: Extension agencies

- Educational institutions

  EXAMPLES: High schools, colleges and universities

- Lobbyists, promotional, and marketing organizations

  EXAMPLE: Oklahoma Wheat Commission

- Public and private businesses and institutions
  - Food processing companies
  - Chemical companies
  - Feed and equipment suppliers
  - Agricultural insurance and finance companies and associations
  - Communications and publishing companies or agencies
  - Producers

OBJECTIVE 8	**Complete Assignment Sheet 4.**
OBJECTIVE 9	**Complete Assignment Sheet 5.**
OBJECTIVE 10	**Complete Assignment Sheet 6.**

ASSIGNMENT SHEET 1

CAREERS

A-3

Name ______________________ Score __________

OBJECTIVE 2

Compare degree requirements in crop science from two colleges or universities.

EQUIPMENT AND SUPPLIES

- Handout 2 *Colleges and Universities*
- Two college catalogs listing degree requirements

INSTRUCTIONS

Your instructor will provide you with catalogs from two colleges or universities that offer degrees in crop science. In Part 1, you will list the requirements for a specific crop science degree. In Part 2, you will write a short essay comparing the requirements.

☑ **NOTE:** You may wish to investigate the cost of the degree, if the information is provided in the catalogs. Colleges and universities generally charge a fixed rate per hour for tuition. Keep in mind that you will also have living expenses while attending school.

Reading Comprehension
- Gain factual information

Research and Reference
- Use in-book reference tools

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

Part 1: List the degree requirements

In the space below, list the degree requirements for the two schools.

Degree ______________________________

School No. 1 ______________	**School No. 2** ______________
______________	______________
______________	______________
______________	______________
______________	______________
______________	______________
______________	______________

Degree requirements (continued)

School No. 1 ____________ **School No. 2** ____________

Part 2: Essay

Write a short essay in the space provided below comparing the two degree requirements. Use correct grammar, spelling, and punctuation.

ASSIGNMENT SHEET 2 — CAREERS

A-3

Name ______________________ Score __________

OBJECTIVE 3 **Compare salaries and benefits in various careers.**

INTRODUCTION

Different crop science careers have different salaries and benefits. For example, a farmer's salary and benefits will be different from those of an equipment salesperson. Benefits include items such as health insurance, paid vacation, etc. When considering a career you must also look at items such as working conditions and opportunities for advancement. By evaluating all aspects of a career, including salary, benefits, and other factors, you will be able to find a career that is right for you.

INSTRUCTIONS

In this Assignment Sheet you will research salaries, benefits, and other factors (working conditions, etc.) for jobs in crop science. Research two positions for each educational level.

Sources of information include:

- interviews with friends and family
- government publications such as USDA publications
- career literature and computer programs at your local library, school career counseling office, or vo-tech school

  EXAMPLE: *Oklahoma Career Search*
- interviews with people in your community
- career counselors at your school
- advertisements for positions

Reading Comprehension
- Gain factual information

Research and Reference
- Select useful resources
- Locate resources
- Use computer data base

Listening
- Apply active listening skills

Interactive Communications
- Conduct/receive interviews

High School Degree

Position #1: ____________________

Entry-level salary ____________________

Mid-level salary ____________________

Top salary ____________________

Benefits ____________________

Other Factors ____________________

Position #2: ____________________

Entry-level salary ____________________

Mid-level salary ____________________

Top salary ____________________

Benefits ____________________

Other Factors ____________________

2-Year Associate Degree or Vocational Program

Position #1: ______

Entry-level salary ______

Mid-level salary ______

Top salary ______

Benefits ______

______

______

______

Other Factors ______

______

______

______

Position #2: ______

Entry-level salary ______

Mid-level salary ______

Top salary ______

Benefits ______

______

______

______

Other Factors ______

______

______

______

4-Year College Degree

Position #1: ______________________________

Entry-level salary ______________________________

Mid-level salary ______________________________

Top salary ______________________________

Benefits ______________________________

____

____

____

Other Factors ______________________________

____

____

____

Position #2: ______________________________

Entry-level salary ______________________________

Mid-level salary ______________________________

Top salary ______________________________

Benefits ______________________________

____

____

____

Other Factors ______________________________

____

____

____

Advanced College Degree

Position #1: ____________________

Entry-level salary ____________________

Mid-level salary ____________________

Top salary ____________________

Benefits ____________________

Other Factors ____________________

Position #2: ____________________

Entry-level salary ____________________

Mid-level salary ____________________

Top salary ____________________

Benefits ____________________

Other Factors ____________________

ASSIGNMENT SHEET 3

CAREERS

A-3

Name ______________________________ Score __________

OBJECTIVE 6

Interview someone in the crop science industry.

INSTRUCTIONS

Reading Comprehension
- Gain factual information

Research and Reference
- Select useful resources
- Locate resources

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

Research
- Take notes

Functional Writing
- Write letters

Listening
- Apply active listening skills

Interactive Communications
- Conduct/receive interviews

You have to have an understanding of a position in order to consider it as a possible career. Informational interviews provide you with significant information about job possibilities, requirements, advantages, disadvantages, compensation, fringe benefits, and clues about whether a job might be right for you.

This Assignment Sheet provides you with an opportunity to interview someone in the crop science industry. The purpose of this interview is to get as much information as possible. In order to do that, you must prepare questions before the interview.

In Part 1, you will provide your instructor with the name and company (or agency) of the person you wish to interview and the individual's position in the company (or agency). Once your instructor has approved your choice, move on to Part 2. If you have difficulty finding someone to interview, ask your instructor for assistance. Your instructor may choose to have one or more resource individuals speak to the class instead of conducting personal interviews.

In Part 2, you will do some preliminary research on the company. For example, if the person you are interviewing works as a researcher in genetic engineering of plants you should read several articles on genetic engineering. You will also prepare a list of at least ten questions to ask the person. Have your instructor approve your questions prior to completing Part 3, the interview. If a speaker is coming to class, your instructor will give a brief overview of the company or agency. You will still need to prepare questions to ask the speaker.

In Part 3, you will complete the interview then write and send a follow-up thank you letter. Dress appropriately for the interview; look neat and clean. Ask your questions, listen, and take notes. After the interview, write the person a short letter thanking him or her for taking the time to visit with you. Have your instructor check the letter. Write or type it neatly, then send it. If an individual speaks to the class, send a thank you from the entire class.

In Part 4, you will write a short essay describing your findings.

Part 1: Name and company of the person to interview or class speaker

Name of individual: ______________________________

Position: ______________________________

Company or agency: ______________________________

Part 2: Preliminary research and questions

Write a minimum of ten questions in the space provided below.

Part 3: Completing the interview and sending a thank-you letter

Arrive at the interview location promptly and prepared. If a speaker is coming to class, listen and ask questions. Be courteous to the speaker. Show your appreciation and keep the thank-you letter brief. Before sending the letter, your instructor should review it.

Part 4: Essay

Write a short essay summarizing the information that you learned during your interview.

ASSIGNMENT SHEET 4

CAREERS

A-3

Name ______________________________ Score __________

OBJECTIVE 8

Identify organizations involved in production, sales, or services of crops in your community, county, or area.

EQUIPMENT AND SUPPLIES

- Local yellow pages

INTRODUCTION

There are many businesses and agencies that support crop production, both directly and indirectly. Businesses such as equipment dealerships, chemical companies, and marketing agencies are necessary to support the production of crops. State and federal agencies give assistance to farmers both from government financial programs and educational information. Many other businesses and agencies also support crop science.

INSTRUCTIONS

In this Assignment Sheet, you will identify some organizations that are necessary to support crop science in your community. In Part 1 you will be responsible for identifying at least one organization within the following categories: retail, wholesale, production, education, transportation, and service. Use your local yellow pages and personal interviews to identify organizations in your area. In Part 2, you will write a short essay describing at least three occupations from the organizations.

Research and Reference
- Select useful resources
- Locate resources
- Use in-book reference tools

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

Part 1: Organizations

Retail

____

____

Wholesale

____

____

532

Listening
- Apply active listening skills

Interactive Communications
- Conduct/receive interviews

Production

Education

Transportation

Service

Part 2: Occupations

ASSIGNMENT SHEET 5

CAREERS

A-3

Name ______________________________ Score __________

OBJECTIVE 9

Outline a presentation on crop science careers.

EQUIPMENT AND SUPPLIES

- Resource materials

INTRODUCTION

The ability to research information and put ideas together is important in many agricultural careers. Many jobs require people to present reports on different aspects of their field.

INSTRUCTIONS

In this Assignment Sheet you will be outlining a presentation. In Assignment Sheet 6 you will give the presentation to the class.

Reading Comprehension
- Gain factual information

Research and Reference
- Select useful resources
- Locate resources

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Develop preliminary outline

Research
- Take notes

PART 1

Decide on a topic and clear it with your instructor before you begin putting your speech together.

Topic ____

Why is this topic interesting to you? ____________________

____

____

Why would it be interesting to your audience? ______________

____

____

What resources will you use to get information? (who will you talk to, what will you read?)

____

____

____

____

____

____

PART 2

Title of Speech ______________________

Introduction

Attention getter ______________________

____

____

____

How will I relate my topic to this audience ____________

____

____

____

Statement of the topic ____________________

____

____

____

Body

Use a separate sheet of paper to outline the body of your presentation. Decide what main points will be covered and the subpoints under each main point. Use the Roman numerals I, II, III, etc. for your main points and the letters A, B, C, etc. for your subpoints.

Include your examples and explanations. Write transitions between main points.

Summary

List major points to be included in the summary.

Conclusion

How will you conclude the speech so that the audience knows the speech is finished?

Timing

The speech should be 3-5 minutes in length. Time the speech, using the outline to practice at home. Do it three times and calculate the average length.

Time ______________________________

What can you do to help you stay within the time limit?

Show this sheet to your instructor for helpful guidance.

ASSIGNMENT SHEET 6

CAREERS

A-3

Name ______________________________ Score __________

OBJECTIVE 10

Give a presentation on a career in crop science.

INTRODUCTION

Many agricultural jobs require people to give presentations. Developing the confidence and skill to speak in front of an audience will help you in any career.

INSTRUCTIONS

Oral Presentation
- Make informative presentations
- Use good speaking techniques
- Select/use words effectively
- Use effective body language
- Present appropriate appearance
- Integrate audio and/or visual materials into oral presentations

Using the outline you prepared in Assignment Sheet 5 prepare a 3-5 minute oral presentation. You may choose to use visual aids, such as posters or photos to aid in your presentation. Your instructor will schedule a time for you to give the presentation to the class. When giving your presentation follow these guidelines:

- Speak in a clear voice that is loud enough for everyone to hear.
- Avoid the use of slang terms such as "ain't" and unnecessary pauses such as "um.."
- Look at your audience (eye contact).
- Use notecards.
- Talk to the audience rather than read your speech.
- Be enthusiastic.

Your speech will be evaluated using the following criteria:

Introduction

- Kept the audience's attention
- Related to audience

- Clearly stated topic
- Topic sufficiently narrow

Content and Structure

- Main points were clear
- Developed ideas logically
- Used transitions
- Summarized main points
- Conclusion ended the speech clearly

Delivery

- Could be heard
- Willingness to share with the audience (confidence)
- Eye contact
- Physical expressiveness (face, gestures, movement, ease)

OBJECTIVE SHEET — *SOILS* — B-1

INTRODUCTION

The study of soils provides information that can benefit farmers, engineers, builders, wildlife and recreation specialists, and many others who depend on and benefit from soils. Various soils have different textures and characteristics which make them suitable for certain purposes. Soil surveys provide detailed information about soils. Individuals who work with soils should have a basic understanding and knowledge of soil.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS	
PREREADING:	Read OSU Fact Sheet No. F-2207, *How To Get a Good Soil Sample* or F-2227, *Using Soil Data in Community Planning.*
WRITING:	Write a short essay on the information contained in the publication. Include a discussion on why knowledge of soil science is important for the particular use in the publication.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment and Job Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Describe the components of a soil survey report.
2. List the uses of a soil survey report.
3. Name groups of people who benefit most from a soil survey report.
4. Describe the types of soil water.
5. Select from a list the primary, secondary, and micronutrients found in soil.
6. Describe the soil textures.
7. Match soil structures to their definitions.
8. Describe the horizons of a soil profile.
9. Identify soil classification using a soil survey. (Assignment Sheet)
10. Determine soil texture by touch. (Job Sheet 1)
11. Perform a soil profile examination. (Job Sheet 2)

INFORMATION SHEET | ***SOILS*** | **B-1**

OBJECTIVE 1

Optional Activities/ Resources in Instructor's Guide

Describe the components of a soil survey report.

☑ **NOTE:** A soil survey report has four major components which are listed below.

- Set of soil maps – soil maps can cover large areas, such as states or regions; more detailed maps cover areas such as counties; farm maps cover areas used by individual farmers
- Map legends which explain symbols used on the maps – map symbols give information about items such as slope, erosion, and landscape features
- Descriptions of the soils – includes information on the taxonomy of the soil, a brief description of the soil, and soil properties of each horizon

  ☑ **NOTE:** The USDA system of soil classification lists six levels of soil classes: Order, Suborder, Great Group, Subgroup, Family, and Series. Individuals who use soils at the local level, such as farmers and builders, are more concerned with the lowest soil grouping, the *soil series.*

- Use and management reports for the soils – information on the appropriate uses of the soil such as for crops and pastures, woodlands, recreation, wildlife habitat, and engineering projects

601

OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

List the uses of a soil survey report.

WORDS YOU SHOULD KNOW	
field map	map that divides land into fields; the farmer can use a field map as a recordkeeping and management tool for such uses as recording crop rotations, pesticide applications, problem areas in the field such as rocks, etc.

- Aid in land-use management and planning
- Planning for civil and industrial projects

  EXAMPLES: Highways, landfills
- Help in determining building sites
- Help in choosing new land for growing crops
- Help in planning irrigation and other engineering projects
- Provides information regarding yields of principal crops
- Used in preparing field maps
- Provides the basic soil characteristics that are used to place soils into land capability classes

  ☑ **NOTE:** There are eight land capability classes. These classes indicate the best long-term use of the land such as for cropping, pasture, rangeland, woodland, recreation, and wildlife.
- Helps in determining the value of the land for agricultural uses

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

Name groups of people who benefit most from a soil survey report.

- Farm Service Agency
- Banks, land appraisers, and tax assessors
- Engineers (highway and others)
- Farmers, ranchers, and farm managers
- Planning boards, health officials, and municipal officials
- Natural Resources Conservation Service
- Agricultural education teachers and county extension agents
- Wildlife and recreational departments

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Describe the types of soil water.

WORDS YOU SHOULD KNOW	
soil-water potential	the potential energy contained in soil water; the work water can do when it moves from the soil to a pool of pure, free water

- **Saturation** – all soil pores are completely filled with water
- **Field capacity** – maximum amount of water left in the soil after drainage ceases and no surface evaporation has occurred

  ☑ **NOTE:** At field capacity, the soil-water potential is high. Plants can obtain moisture from the soil since water is held loosely in the soil.

- **Wilting point** – the point at which plants cannot obtain enough water to supply their transpiration needs

  ☑ **NOTE:** The moisture content of the field should be between the field capacity and the wilting point. The **hygroscopic coefficient** is the point at which the soil is air dry; past the wilting point, some capillary water may remain but is unavailable to plants. When this water evaporates only a thin film of adhesion water is left.

OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Select from a list the primary, secondary, and micronutrients found in soil.

☑ **NOTE:** There are 16 essential elements for plant growth. Carbon, oxygen, and hydrogen are provided by the air and water and account for 95% of plant needs. The 13 remaining essential nutrients are obtained from the soil.

PRIMARY NUTRIENTS

- Nitrogen
- Phosphorus
- Potassium

SECONDARY NUTRIENTS

- Sulfur
- Calcium
- Magnesium

MICRONUTRIENTS

- Boron
- Chlorine
- Copper
- Iron

- Manganese
- Molybdenum
- Zinc

☑ **NOTE:** There are many other elements, such as nickel and sodium, which occur in most soils and may be found in plants. The role that these other elements have in plant growth has not yet been established.

OBJECTIVE 6

Describe the soil textures.

Required Activities/ Resources
- Transparency Master

Optional Activities/ Resources in Instructor's Guide

WORDS YOU SHOULD KNOW	
loam soils	soils which contain particles of sand, silt, and clay in proportions so that the characteristic of no one particle dominates
texture	refers to the characteristic of soil that is determined by the mixtures and proportions of different-sized particles

☑ **NOTE:** The divisions of soil texture from largest to smallest are sand, silt, and clay. Combinations of the soil texture divisions are common. Examples of combination soils are fine sandy loam and silty clay loam. Table 1 shows the comparison in sizes of sand, silt, and clay. Figure 1 shows the soil triangle which is used to determine the soil texture.

- **Sand** – sandy soils have particles which are finer than gravel soils but are coarse enough for each individual particle to be visible; sandy soils are open and have good drainage; sandy soils are good for vegetable and other early season crops if sufficient water is available

  ☑ **NOTE:** To be classified as sandy, clay and silt must make up less than 20 percent by weight of the material. Sand is further divided into subcategories: very coarse sand, coarse sand, medium sand, fine sand, very fine sand.

- **Silt** – silt particles are smaller than sand particles and cannot be seen; silt particles feel silky or powdery; silt particles are intermediate in size between sand and clay particles and are important elements in loam soils

- **Clay** – clay particles are the smallest-sized individual particles; clay particles stick together and so are not individual grains in the soil; clay soils have high water-holding capacity; clay soils generally tend to be fertile and retain plant nutrients

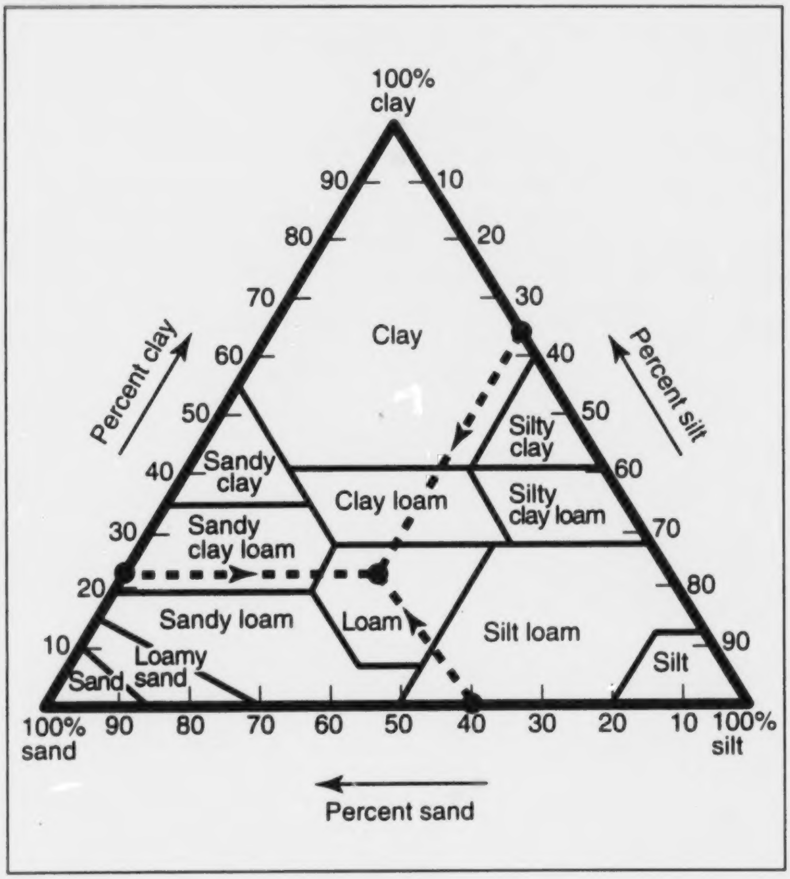
  ☑ **NOTE:** A soil must contain at least 40 percent of fine clay particles to be classified as a clay.

TABLE 1

Separate	**Diameter (mm)**
Very coarse sand	2.00 - 1.00
Coarse sand	1.00 - 0.50
Medium sand	0.50 - 0.25
Fine sand	0.25 - 0.10
Very fine sand	0.10 - 0.05
Silt	0.05 - 0.002
Clay	Less than 0.002

☑ **NOTE:** Gravel and stone particles greater than 2.0 mm in diameter are generally not considered a part of the soil texture. However, they are often a part of the soil and can affect its use.

FIGURE 1


100% clay
90
80
70
60
50
40
30
20
10
10
20
30
40
50
60
70
80
90
Percent clay
Percent silt
Clay
Silty clay
Sandy clay
Clay loam
Silty clay loam
Sandy clay loam
Sandy loam
Loam
Silt loam
Loamy sand
Sand
Silt
100% sand
90
80
70
60
50
40
30
20
10
100% silt
Percent sand

☑ **NOTE:** Each side of the triangle represents a soil separate. The numbers represent the percentage of soil particles of that type.

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

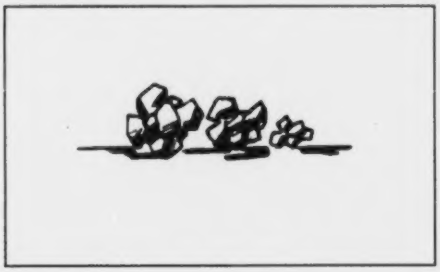
Match soil structures to their definitions.

WORDS YOU SHOULD KNOW	
aggregates	large units of soil
consistence	the feel of the soil; how easily a lump of soil can be crushed
soil aeration	the exchange of air in the soil with air from the atmosphere
soil structure	the arrangement of primary soil particles; the way soil clumps together in large units
tilth	the condition of the soil from tillage, seedbed preparation, seedlings, and roots

☑ **NOTE:** The physical characteristics of soil and its capability for plant growth depend on the soil texture, soil structure, consistence, aeration, tilth, and moisture. Soil structures are defined below.

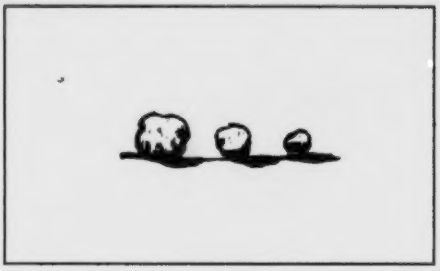
- **Crumb** – structure in which particles are grouped into very porous, irregularly sized grains

FIGURE 2



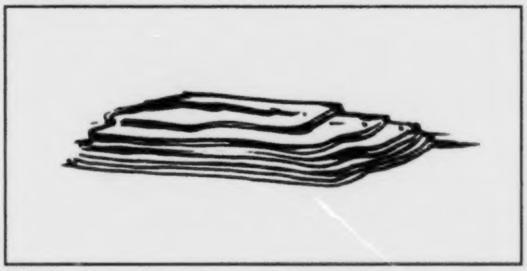
- **Granular** – structure in which particles are grouped into spherical aggregates with indistinct sides

FIGURE 3



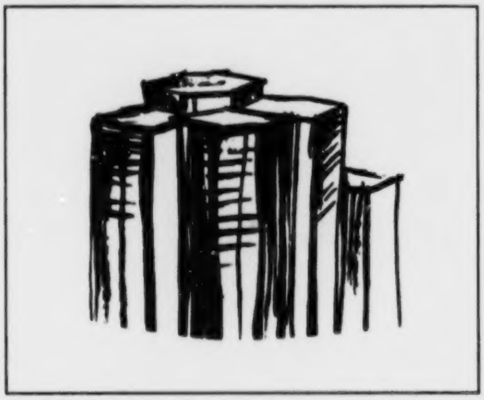
- **Platy** – structure in which particles are grouped into flat, tubular aggregates with a thin vertical axis and a long horizontal axis

FIGURE 4



- **Prismatic** – structure in which particles are grouped into prismlike aggregates with a vertical axis that is longer than the horizontal axis

FIGURE 5



- **Blocky** – structure in which particles are grouped into round (subangular) or angular aggregates with equal sides

FIGURE 6

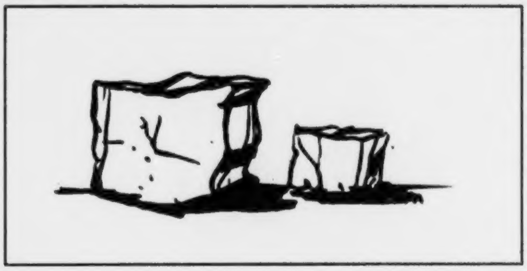
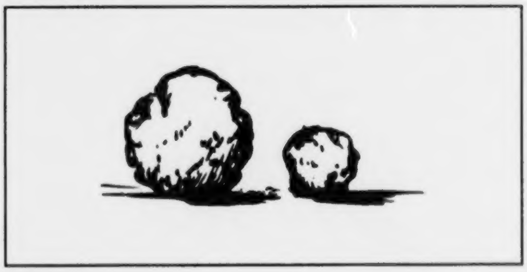
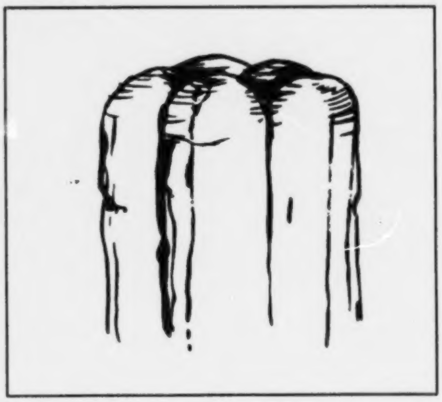


FIGURE 7



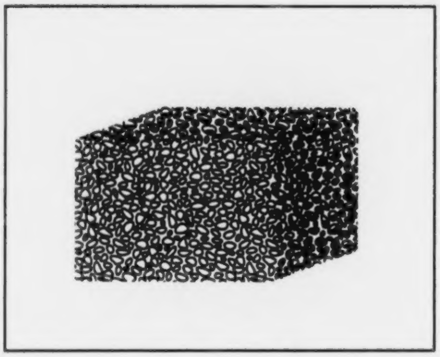
- **Columnar** – structure in which particles are grouped into columnlike aggregates with a vertical axis that is longer than the horizontal axis

FIGURE 8



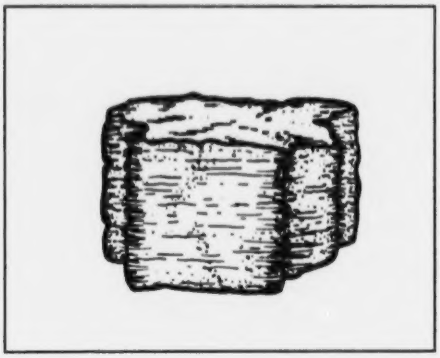
- **Single-grain** – each grain behaves individually

FIGURE 9



- **Massive** – particles adhere together into a solid mass

FIGURE 10



☑ **NOTE:** Single-grain and massive soils are referred to as structureless soils.

611

OBJECTIVE 8

Optional Activities/ Resources in Instructor's Guide

Describe the horizons of a soil profile.

WORDS YOU SHOULD KNOW	
eluviation	loss of clay, iron, and other minerals to leaching
illuviation	accumulation of chemicals
solum	the A, E, and B horizons; known as the true soil, most plant roots grow in the solum

- **O Horizon** – an organic layer of fresh and decaying plant and animal residue at the surface of a mineral soil

  EXAMPLE: Fallen leaves, branches, and other debris make up the O horizon in a forest

- **A Horizon** – the surface mineral layer where organic matter accumulates; often called topsoil, provides the best environment for the growth of plant roots, microorganisms, and other life

- **E Horizon** – the zone of greatest eluviation; the E horizon is very leached of clay, chemicals, and organic matter

- **B Horizon** – usually referred to as the subsoil, the zone where chemicals leached out of the A horizon accumulate; the B horizon has a lower organic matter content than the A horizon and often has more clay

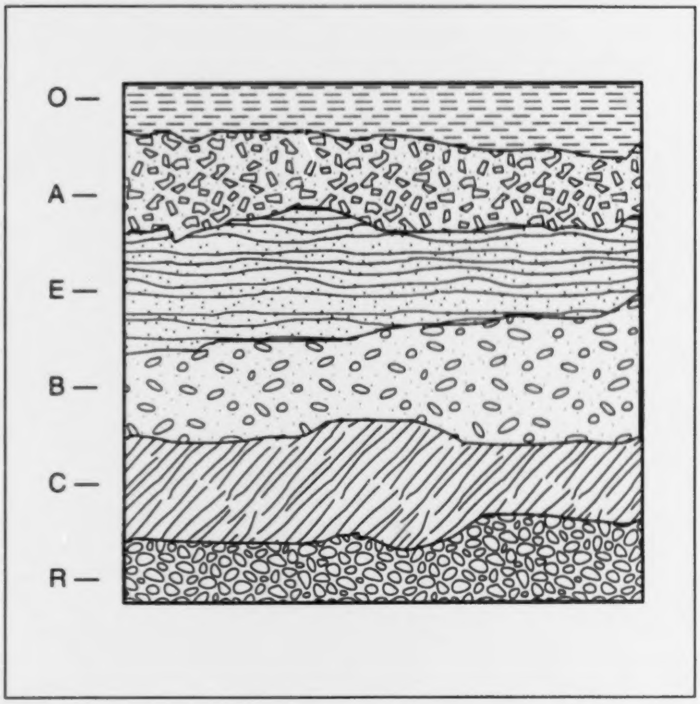
- **C Horizon** – the layer that is little affected by the soil-forming processes; the C horizon does not have the properties of the A and B horizons; usually the parent material of the soil

- **R Horizon** – the underlying bedrock beneath the soil

  EXAMPLES: Limestone, sandstone, granite

☑ **NOTE:** Figure 11 shows a soil profile.

FIGURE 11



OBJECTIVE 9 **Complete the Assignment Sheet.**

OBJECTIVE 10 **Complete Job Sheet 1.**

OBJECTIVE 11 **Complete Job Sheet 2.**

ASSIGNMENT SHEET — SOILS — B-1

Name ______________________________ Score __________

OBJECTIVE 9

Identify soil classification using a soil survey.

EQUIPMENT AND SUPPLIES

- Samples of soil surveys

INSTRUCTIONS

Using the soil survey provided by your instructor, follow the instructions below.

1. Locate the area of interest indicated by your instructor on the "Index to Map Sheets" in the soil survey. Write the number of the map sheet below and then turn to that map sheet.

   ____

2. Locate the area of interest on the map sheet. List the mapping unit symbols in the area in the blanks below.

   ____

   ____

   ____

3. Refer to the "Index to Soil Mapping Units" in the survey. This lists the name of each mapping unit and page on which it is described. Write the name of the soils and a brief description of them in the blanks below.

   ____

   ____

   ____

   ____

   ____

Functional Reading
- Interpret forms and records
- Use content area vocabulary

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Earth Science
- Investigate physical characteristics of the earth

4. Refer to "Summary of Tables" for additional information on a specific soil use. Your instructor will specify the intended use of the soil. Use the tables to find out what the soil survey can tell you about the soil. For example, grazing yields per acre. Write a brief discussion on the soil and its uses and limitations in the blanks provided.

5. For further information on specific uses of soil, refer to the contents portion of the soil survey.

JOB SHEET 1

SOILS

B-1

Name ______________________________

OBJECTIVE 10

Determine soil texture by touch.

You will see the video *Land Judging* which shows the procedure for determining soil texture by touch.

EQUIPMENT AND SUPPLIES

- Samples of four different soil textures
- Water

PROCEDURE

Functional Reading
- Follow written instructions

Earth Science
- Investigate physical characteristics of the earth

Cognitive Activities
- Analyze/synthesize information
- Draw conclusions

	Yes	No
1. Acquire the soil sample.	____	____

☑ **NOTE:** The sample should be free of gravel and debris.

	Yes	No
2. Wet the soil sample until it is uniformly moist and is workable.	____	____
3. Feel the soil between the thumb and forefinger.	____	____

☑ **NOTE:** Sand will be gritty, not sticky. Loamy soils have a wide range of textures. Clayey soils have very little grit and are sticky.

	Yes	No
4. Try to form a ribbon with the soil.	____	____

☑ **NOTE:** Sandy soils will form a short, fragile ribbon. Clayey soils will form a long, stable ribbon.

	Yes	No
5. Determine the soil texture by putting your observations together.	____	____
6. Repeat the procedure for each soil sample.	____	____

SKILL TEST RECORD

EVALUATOR'S COMMENTS

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Ribbon squeezed	4	3	2	1
Texture determined	4	3	2	1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

4 **Skilled** – Can perform job with no additional training.
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
1 **Unskilled** – Is familiar with process, but is unable to perform job.

EVALUATOR'S COMMENTS

JOB
SHEET 2

SOILS

B-1

Name ______________________________

OBJECTIVE 11

Perform a soil profile examination.

EQUIPMENT AND SUPPLIES

- Soil profile
- Measuring tape
- Markers
- Paper and pencil

PROCEDURE

Functional Reading
- Follow written instructions

Earth Science
- Investigate physical characteristics of the earth

Cognitive Activities
- Collect/record information
- Analyze/synthesize information
- Draw conclusions

	Yes	No
1. Examine the soil for soil horizons.	____	____
2. Using the measuring tape, measure the width of each horizon.	____	____
3. Mark the different horizons with the markers.	____	____
4. Record the horizons and their length, include a brief description of each horizon.	____	____

SKILL TEST RECORD

EVALUATOR'S COMMENTS

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Horizons measured	4	3	2	1
Horizons marked	4	3	2	1
Description recorded	4	3	2	1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

4 **Skilled** – Can perform job with no additional training.
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
1 **Unskilled** – Is familiar with process, but is unable to perform job.

EVALUATOR'S COMMENTS

OBJECTIVE SHEET

SOIL SAMPLING

B-2

INTRODUCTION

Soil sampling is an important management tool for farmers. Soil sampling can help farmers determine nutrient deficiencies in the soil and the appropriate amounts of fertilizer to add to the soil. By properly managing their crops, farmers can expect increased yields. Increased yields often mean a higher income for the farmer. Farmers do not have control over factors such as weather and drought that adversely affect crop yield. But farmers can take soil samples and from their analysis make management decisions that will help increase crop yields.

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS	
PREREADING:	Read *Causes and Effects of Soil Acidity*, OSU Extension Facts No. 2239.
WRITING:	Write a short essay (one page) on the causes of soil acidity. Include a brief discussion of why soil acidity is of concern to farmers and what can be done to correct the problem.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment and Job Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. List reasons for testing soil.
2. Name the major items for which soils are tested.
3. Label a soil pH scale.
4. Select from a list areas from which soil samples should not be taken.
5. Identify tools used to collect soil samples.
6. List the steps for collecting a soil sample.
7. Name locations in Oklahoma where soil samples can be sent for testing.
8. Collect a soil sample. (Job Sheet)
9. Complete a soil analysis form. (Assignment Sheet)

INFORMATION SHEET

SOIL SAMPLING

B-2

OBJECTIVE 1

Optional Activities/
Resources in
Instructor's Guide

List reasons for testing soil.

- Recommend fertilizer amounts to allow for optimum plant growth.

- Determine possible reasons for unsatisfactory plant growth.

  ☑ **NOTE:** Soil testing will not provide answers to all reasons for unsatisfactory plant growth. For example, drought, compacted soils, extremely high or low temperatures, poor drainage, diseases, insect damage, etc. need to be taken into account when interpreting soil analysis.

- Help farmers maximize their profits.

  EXAMPLE: Fertilizing can help to increase yields but the farmer needs to know the amount of fertilizer to add that will provide the optimum plant growth while keeping fertilizer costs down.

OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

Name the major items for which soils are tested.

WORDS YOU SHOULD KNOW	
lime requirement	the amount of agricultural limestone that will raise the pH of a soil to the desired level
soil pH	a number which measures the acidity or hydrogen ion activity of a soil

- Nitrogen

  ☑ **NOTE:** Nitrogen is generally the most limiting nutrient in plant growth. However, it is difficult to accurately test for nitrogen.

- Phosphorus

- Potassium

  ☑ **NOTE:** Nitrogen, phosphorus, and potassium are the *macronutrients* that plants absorb from the soil. These elements are the primary fertilizer nutrients.

- Soil acidity

  ☑ **NOTE:** The pH data will help determine if the soil has a lime requirement.

- Soluble salts
- Calcium
- Magnesium
- Sulfur
- Micronutrients

  ☑ **NOTE:** There has been limited success in developing an accurate test for micronutrient metals such an zinc, iron, manganese, and copper.

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

Label a soil pH scale.

☑ **NOTE:** The entire pH scale ranges from 0 to 14. Numbers below 7 indicate acidity, while numbers above 7 indicate alkalinity and are considered basic or alkaline. The pH value of soils commonly ranges from 5.0 to 8.0. For the production of most crops a pH of around 6.5 (slightly acidic) is considered most preferable. Below is an illustration of the pH ranges most commonly found in soils.

pH scale	Soil Characteristic
3.5	Lowest pH reading for mineral soils
4.0	Strongly acidic
4.5	
5.0	
5.5	Moderately acidic
6.0	
6.5	Slightly acidic
7.0	Neutral
7.5	Slightly alkaline
8.0	Moderately alkaline
8.5	
9.0	Strongly alkaline
10.0	
10.5	Highest pH reading for mineral soils

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Select from a list areas from which soil samples should not be taken.

- Eroded spots
- Areas with visible differences in soils
- Small areas of noticeable differences in crop growth within a field
- Areas in a field that have been manured, limed, or treated differently
- Dead furrows
- Small depressions or low spots
- Fence rows
- Fertilizer spills
- Dirt roads
- Barns

☑ **NOTE:** A soil sample may be taken whenever it is not frozen. However, most recommendations are to take a soil sample as soon before planting as possible. Time needs to be allowed for the grower to react to any problems and order appropriate fertilizer.

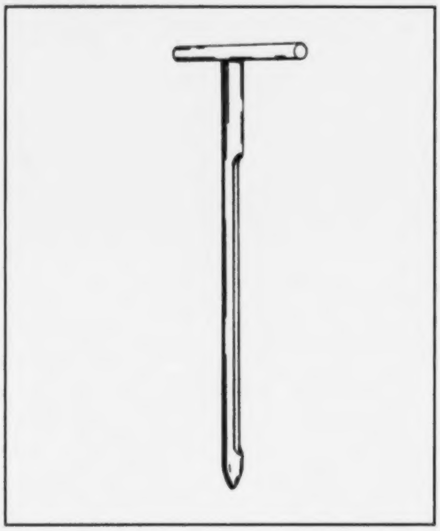
OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Identify tools used to collect soil samples.

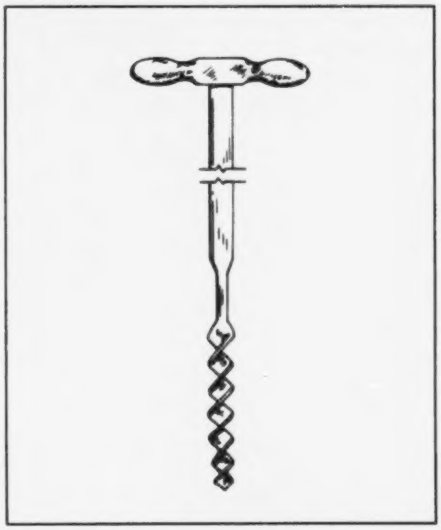
- Soil tube (Figure 1)

FIGURE 1



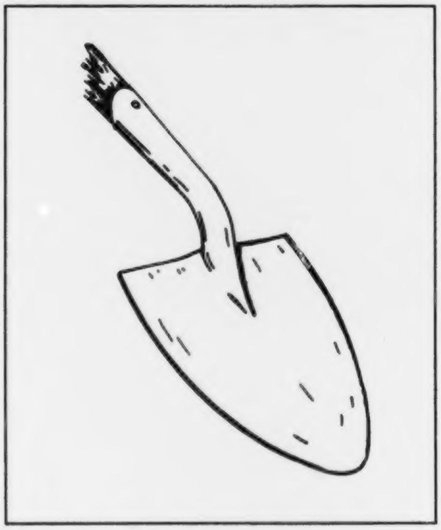
- Soil auger (Figure 2)

FIGURE 2



- Spade (Figure 3)

FIGURE 3



OBJECTIVE 6

Optional Activities/
Resources in
Instructor's Guide

List the steps for collecting a soil sample.

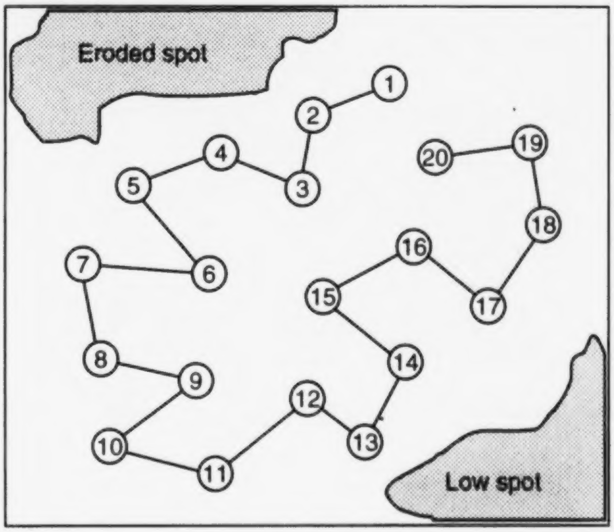
1. Determine the area (field) to be sampled.

   ☑ **NOTE:** The sample obtained will provide an *average* of the field. If there is an area with extremely varying soil properties, the field should be broken down into several smaller areas. The most important factor in determining the area to sample is not size but the variability of the soil.

2. Gather samples from random spots in the field, avoiding areas with unusual conditions. (Figure 4)

   ☑ **NOTE:** At least 20 core samples should be taken from large areas. The soil samples should be placed in a clean plastic bucket. Do not use metal containers because of the risk of metal contamination. Follow the instructions from the testing laboratory regarding items such as depth of soil samples.

   FIGURE 4



3. Mix the subsamples thoroughly.

   ☑ **NOTE:** If the sample is wet, spread the soil out to dry.

4. Place the sample in the container to be sent to the testing laboratory. Include any information required by the testing center.

OBJECTIVE 7

Name locations in Oklahoma where soil samples can be sent for testing.

- Oklahoma State University Soil, Water & Forage Analytical Laboratory – Stillwater, Oklahoma
- Noble Foundation – Ardmore, Oklahoma
- Private labs

OBJECTIVE 8 **Complete the Job Sheet.**

OBJECTIVE 9 **Complete the Assignment Sheet.**

ASSIGNMENT SHEET

SOIL SAMPLING

B-2

Name ______________________________ Score __________

OBJECTIVE 9

Complete a soil analysis form.

EQUIPMENT AND SUPPLIES

- Collected soil samples

INSTRUCTIONS

Using the soil analysis form on the following page, complete the required information.

Functional Writing
- Complete forms and records

Address Code ___ ___ ___ — Sender Number ___ ___ ___ ___

Use pencil only, press hard. Do not put plastic bags inside soil sample bag.

3 **MARK Crop and Fill in Yield Goal (MARK ONE ONLY).**

GRAINS

- ☐ WHEAT (1)
- ☐ BARLEY (2)
- ☐ OATS (3)
- ☐ CORN (5)

YIELD GOAL (bu/A) ______

LEGUMES

- ☐ ALFALFA (21)
- ☐ PEANUTS (14)
- ☐ SOYBEANS (15)
- ☐ MUNGBEANS (16)
- ☐ COWPEAS (17)
- ☐ GUAR (18)
- ☐ LEGUMES IN PASTURE (20)
- ☐ ARROWLEAF CLOVER (35)

NO YIELD GOAL NEEDED

GRASSES

- ☐ FESCUE (9)
- ☐ ORCHARDGRASS (10)
- ☐ RYEGRASS (11)
- ☐ SMALL GRAINS FOR GRAZING (19) .
- ☐ WEEPING LOVEGRASSS (12)
- ☐ BERMUDAGRASS (13)
- ☐ BLUESTEM (34)
- ☐ JOSE TALL WHEATGRASS (36)

YIELD GOAL (tons/A) ______

SILAGE & HAY

- ☐ CORN ENSILAGE (7)
- ☐ SORGHUM ENSILAGE (8)
- ☐ SORGHUM-SUDAN HAY (22)

YIELD GOAL (tons/A) ______

- ☐ GRAIN SORGHUM (4)

YIELD GOAL (cwt/A) ______

- ☐ COTTON (6)

YIELD GOAL (bales/A) ______

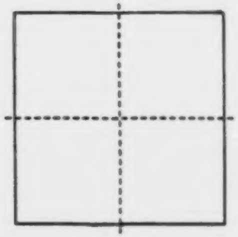
HOMEOWNER

- ☐ HOME GARDEN (23)
- ☐ LAWN (24)

NO YIELD GOAL NEEDED

- ☐ OTHER ______________

Field Location: ______________



Sec. ________ T ________ R ________

FIELD SIZE ________ ACRES

Sampling Depth (Inches) ________

NAME ______________

ADDRESS ______________

COUNTY ______________

LAST YEAR ______________

Crop ________ Yield ________

Pounds/A N ________ P_2O_5 ________ K_2O ________

Tons Lime ________

2 YEARS AGO

Crop ________ Yield ________

Pounds/A N ________ P_2O_5 ________ K_2O ________

Tons Lime ________

EXPECTED MARKET PRICE ______________

PRODUCTION PROBLEMS ______________

JOB SHEET

SOIL SAMPLING

B-2

Name ______________________________

OBJECTIVE 8

Collect a soil sample.

EQUIPMENT AND SUPPLIES

- Soil tube, soil auger, or spade
- Plastic bucket
- Area from which to take soil sample
- Soil sample bags

PROCEDURE

Functional Reading
- Follow written instructions

Earth Science
- Investigate physical characteristics of the earth

Job Acquisition/ Development
- Master specific job task/procedure

Yes No

1. Determine the area to be sampled. ____ ____
2. Remove surface litter from each testing spot. ____ ____
3. Remove a soil sample using a soil auger, soil tube, or spade. Each sample should contain soil from the entire testing depth. ____ ____

   ☑ **NOTE:** If using a spade, dig a V-shaped hole. Remove a slice about ½ inch thick from one side of the V.

4. Place each soil sample in a clean plastic bucket as you collect it. ____ ____
5. Mix all of the subsamples from the sampling area and place it in a soil sample bag. ____ ____
6. Properly label the soil sample. ____ ____
7. Properly clean and store any equipment used. ____ ____

SKILL TEST RECORD

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Determined sampling area	4	3	2	1
Removed surface litter	4	3	2	1
Removed soil sample	4	3	2	1
Placed sample in clean bucket	4	3	2	1
Mixed samples	4	3	2	1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

4 **Skilled** – Can perform job with no additional training.
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
1 **Unskilled** – Is familiar with process, but is unable to perform job.

EVALUATOR'S COMMENTS

____

____

____

OBJECTIVE SHEET

FERTILIZERS AND IRRIGATION

B-3

INTRODUCTION

Fertilizers and irrigation systems are important aspects of agricultural production. Fertilizers replace nutrients removed from the soil by harvested crops, lost by erosion, or otherwise unavailable to the plants. High crop yields are essential for profitable operations. By using fertilizers, nutrient deficiencies limiting growth are eliminated and higher crop yields are possible. Irrigation also makes higher crop yields possible by supplying water when the plants need it. Irrigation also enables land to be placed in crop production which otherwise would not be suitable for farming.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension

- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language

- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition

- Use complete sentences

FOCUS ASSIGNMENTS	
PREREADING:	*Read Knowing When to Fertilize*, OSU Extension Facts No. 2236.
WRITING:	Write a short essay (one paragraph to one page) describing the importance of knowing when to fertilize.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment and Job Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. List factors that influence the use of fertilizers.
2. Describe categories of fertilizers.
3. Describe the forms in which fertilizers are provided.
4. Define green manures.
5. Match methods of applying fertilizers to their descriptions.
6. Name factors to consider in caring for fertilizer equipment.
7. Match the primary plant nutrients to their characteristics.
8. Match the secondary plant nutrients to their characteristics.
9. Name the micronutrients essential to plant growth.
10. Match nutrients to their deficiency symptoms.
11. Explain the Haber process of manufacturing nitrogen fertilizers.
12. Select from a list information that must appear on fertilizer bags according to state law.
13. Define fertilizer ratio.
14. Discuss the percent nutrient value of specified fertilizers.
15. Complete a chart on the most desirable pH scale range for crops.
16. Select from a list the benefits of a liming program.
17. Collect plants with fertilizer deficiencies. (Assignment Sheet 1)
18. Calculate least-cost fertilizer material. (Assignment Sheet 2)
19. Calculate number of pounds of NPK available from different fertilizer analyses. (Assignment Sheet 3)
20. Calculate the cost per pound of nitrogen for different fertilizer analyses. (Assignment Sheet 4)

21. Determine fertilizer application rates, yield, and estimated return. (Assignment Sheet 5)

22. Make a fertilizing schedule. (Assignment Sheet 6)

23. Compare organic and inorganic fertilizing methods and costs. (Assignment Sheet 7)

24. Determine application rate. (Assignment Sheet 8)

25. Apply fertilizer. (Job Sheet 1)

26. List factors which determine whether or not irrigation is feasible.

27. Match types of irrigation systems to their descriptions.

28. Explain the principles of fertigation.

29. Calculate water needs. (Assignment Sheet 9)

30. Determine when to irrigate. (Assignment Sheet 10)

INFORMATION SHEET

FERTILIZERS AND IRRIGATION

B-3

OBJECTIVE 1

Optional Activities/ Resources in Instructor's Guide

List factors that influence the use of fertilizers.

- Chemical condition of the soil

  ☑ **NOTE:** The chemical condition of the soil is dependent on the availability of total nutrients in the soil and soil pH.

- Crops

  ☑ **NOTE:** The type of fertilizer to use is determined by the value of the crop when it reaches market and the crop's ability to absorb the different nutrients when they are available.

- Physical condition of the soil

  ☑ **NOTE:** Moisture content, soil texture, and the ability to prevent leaching are important physical conditions to consider in fertilizer use.

- Insects and diseases
- Climatic conditions
- Time

OBJECTIVE 2

Optional Activities/ Resources in Instructor's Guide

Describe categories of fertilizers.

- **Mineral fertilizers** – ground rocks which contain nutrients; the majority of minerals dissolve slowly limiting their usefulness as fertilizers

  EXAMPLE: Dolomitic lime is a good source of calcium and magnesium.

- **Organic fertilizers** – organic materials that contain nutrients; the benefits of many organic fertilizers are obtained slowly as the organic matter decays

  EXAMPLE: Animal manure

- **Inorganic fertilizers (chemical fertilizers)** – fertilizers made by industry; some may be mined but many are entirely manufactured; generally have a higher proportion of usable nutrients than mineral or organic fertilizers

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

Describe the forms in which fertilizers are provided.

- **Pressurized liquids** – liquid is applied by injecting it into the soil from tanks; pressure in the tanks forces the liquid through chisels that are pulled underground; when the liquid reaches the soil, it evaporates

  EXAMPLE: Anhydrous ammonia

- **Fluid fertilizers** – liquids that are not under pressure; solutions are the most common fluid fertilizers; suspensions can also be used; fluid fertilizers can be applied in various ways such as by spraying on a field, injecting into the soil, or mixing with irrigation water

- **Dry fertilizers** – fertilizers that are applied to soil and dissolve quickly in soil water to release nutrients; available in three forms: pulverized fertilizers which are powders made from crushing fertilizers; granules, which are large, evenly sized grains; and prills which are smooth, round, and dust-free

- **Slow-release fertilizers** – dry fertilizers which contain nutrients that dissolve into the soil solution slowly; time period generally ranges from several weeks to a few months; most commonly used in horticulture

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Define green manures.

Green manures are crops that are grown for the purpose of being turned under while green or immediately after maturity for soil improvement.

☑ **NOTE:** The benefits of green manures include supplying fresh food for beneficial soil organisms, making nutrients more available, and adding atmospheric nitrogen if they are legumes. Green manure crop residues may also help reduce the severity of fungal diseases. Green manure crops are often needed on intensively fertilized crops such as peanuts and nursery crops to reduce losses of nitrates and soil sediments. Examples of green manure crops are cowpeas and clovers.

OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Match methods of applying fertilizers to their descriptions.

WORDS YOU SHOULD KNOW	
split application	dividing the year's fertilizer into two or more parts; often a portion of the fertilizer is applied before planting and then later applications are made after growth has started

FERTILIZING BEFORE PLANTING

- **Broadcast** – fertilizer is uniformly spread over the soil by the use of equipment or aircraft
- **Soil injection** – fertilizers are injected into the soil

  ☑ **NOTE:** Anhydrous ammonia must be injected into the soil because ammonia evaporates quickly.

FERTILIZING AT PLANTING

- **Starter (pop-up)** – fertilizer is applied in the row with the seed at the time of seeding for immediate use by the young seedling

  ☑ **NOTE:** Usually only a small amount of fertilizer is used to avoid damaging the seed.

- **Row placement (band placement)** – application of fertilizer to one side and below the level of the seed

  ☑ **NOTE:** The placement of the dry fertilizer is placed far enough away to avoid damaging the seed but close enough so that the young roots can find the band of fertilizer.

FERTILIZING AFTER PLANTING

- **Foliar** – application of liquid fertilizer directly on the foliage of plants
- **Top dressing** – application of fertilizer over a growing crop

  ☑ **NOTE:** Top dressing is similar to broadcasting except the fertilizer is spread over growing plants and is not mixed into the soil. Dry or fluid fertilizers may be applied by top dressing.

- **Side dressing** – application of fertilizer along the crop row
- **Fertigation** – application of fertilizer in irrigation systems

OBJECTIVE 6

Optional Activities/
Resources in
Instructor's Guide

Name factors to consider in caring for fertilizer equipment.

- Remove all fertilizer from the hopper after use.
- Clean the hopper thoroughly with water.
- Allow the hopper to dry.
- Clean out the auger.
- Apply a mixture of 50% kerosene and oil to the hopper.

☑ **NOTE:** Fertilizer should be stored in a dry location, with no direct contact with outside walls or concrete floor. If the storage location has a concrete floor, use lumber to construct a false floor.

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

Match the primary plant nutrients to their characteristics.

☑ **NOTE:** Plants need the right proportion of primary nutrients for optimum growth.

- Nitrogen
  - Is part of all living plant cells
  - Promotes rapid growth

    ☑ **NOTE:** Nitrogen is of major importance in plant growth and is often the limiting nutrient in plant growth. Nitrogen generally promotes vegetative growth (stems and leaves) rather than the growth of flowers and fruit. Nitrogen is especially important for plants grown for their vegetation, such as hay, but it is also important to fruiting plants since they require good growth to flower. Plants with adequate nitrogen are often more tender and succulent because of thinner cell walls.

  - Gives dark green color because of chlorophyll production

  - Increases protein content of plant tissue

    ☑ **NOTE:** The greater protein content makes the plant a more nutritious forage or feed source.

  - Increases crop yields
  - Increases the proportion of water in plant tissues

- Phosphorus
  - Is part of all living plant cells
  - Aids in cell division and reproduction

    ☑ **NOTE:** The nucleus of each plant cell contains phosphorus. Adequate phosphorus is needed for cell division and growth.

  - Stimulates root growth
  - Speeds crop maturity
  - Helps plants resist cold and disease
  - Aids in fruiting and seed production

- Potassium
  - Helps in the transformation and translocation of sugars, starches, celluloses, and other carbohydrates
  - Helps in translocation from the leaves to the roots
  - Promotes health and vigor of plants
  - Promotes tougher growth and strong stems which reduces lodging

    ☑ **NOTE:** Potassium balances the effects of nitrogen; potassium promotes a tougher growth and nitrogen promotes tender growth.

  - Influences the transpiration rate by regulating the stoma

    ☑ **NOTE:** A plant that has an adequate supply of potassium transpires less and uses water more efficiently.

  - Produces plumper seed

OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

Match the secondary plant nutrients to their characteristics.

- Calcium
  - ☐ Promotes root and leaf growth
  - ☐ Helps plants build cell walls

    ☑ **NOTE:** Plants need calcium the most where cells are dividing rapidly such as in the root and tip shoots.

  - ☐ Makes cells more selective in absorption of nutrients

    ☑ **NOTE:** Calcium is a part of the middle layer of each cell wall and tends to make cells more selective in absorption of nutrients.

  - ☐ Controls soil pH
  - ☐ Aids in protein formation and carbohydrate movement
  - ☐ Is necessary for the nodule formation of legumes
- Magnesium
  - ☐ Essential ingredient in chlorophyll

    ☑ **NOTE:** Each molecule has one magnesium atom at its center.

  - ☐ Aids in the uptake of phosphorus
  - ☐ Regulates the uptake of other plant nutrients
  - ☐ Is important in plant enzyme system
  - ☐ Aids in the formation of fats and oils
  - ☐ Aids in the movement of starch
- Sulfur
  - ☐ Aids in nodule formation on legumes
  - ☐ Aids seed production
  - ☐ Stimulates more vigorous plant growth
  - ☐ Necessary for making chlorophyll

OBJECTIVE 9

Optional Activities/
Resources in
Instructor's Guide

Name the micronutrients essential to plant growth.

☑ **NOTE:** Micronutrients are essential to plant growth but are used in minute quantities.

- Boron
- Iron
- Manganese
- Zinc
- Copper
- Chlorine
- Molybdenum

OBJECTIVE 10

Optional Activities/
Resources in
Instructor's Guide

Match nutrients to their deficiency symptoms.

WORDS YOU SHOULD KNOW	
chlorosis	symptom characterized by plants lacking the dark green color; leaves turn light green, then yellow; starts with the lower leaves

- Nitrogen
  - ☐ Slow growth and stunting
  - ☐ Chlorosis
- Phosphorus
  - ☐ Stunted growth but plant remains green
  - ☐ Purple tint to the leaves and stems
- Potassium
  - ☐ Burned appearance on the edges of lower leaves

- Calcium
    - Problems with shoot tips
- Magnesium
    - Chlorosis
- Sulfur
    - Stunted growth
    - Older leaves are pale green

    ☑ **NOTE:** Symptoms of sulfur deficiency resemble those of nitrogen deficiency.

OBJECTIVE 11

Optional Activities/ Resources in Instructor's Guide

Explain the Haber process of manufacturing nitrogen fertilizers.

WORDS YOU SHOULD KNOW	
anhydrous	without water

- The *Haber process* is the process by which fertilizer companies manufacturer most nitrogen carriers.
- Nitrogen from the air is used in the Haber process. The hydrogen source, natural gas, is combined with gaseous nitrogen.
- Ammonia is produced from this reaction, with the presence of heat, pressure, and an iron catalyst.
    - $3H_2 + N_2$ ----> $2NH_3$
- Ammonia can then be used as a fertilizer or changed to other forms.
    - Anhydrous ammonia results directly from the Haber process. It is 82% nitrogen.

- Anhydrous ammonia is relatively inexpensive compared to other forms of nitrogen fertilizer and is the strongest form of nitrogen.

  ☑ **NOTE:** The use of anhydrous ammonia is increasing because of its cost and strength. But if it is not injected deep enough into the soil, it may evaporate and be lost. Ammonia will damage lung tissue if inhaled; proper precautions must be taken during transport and application of ammonia.

OBJECTIVE 12

Optional Activities/
Resources in
Instructor's Guide

Select from a list information that must appear on fertilizer bags according to state law.

- Net weight of the contents of the package or parcel
- Brand name and grade of commercial fertilizer
- Name and address of the registrant or the person guaranteeing the commercial fertilizer
- Guaranteed analysis showing the minimum percentage of plant food claimed in the following order and form:

  Total Nitrogen (N) percent
  Available Phosphoric Acid (P_2O_5) percent
  Soluble Potash (Potassium) (K_2O) percent

☑ **NOTE:** Fertilizers with pesticides must show additional items such as the name of the pesticide; active, inert, and total ingredients; source of material; caution statement; directions for use; container disposal directions; EPA Reg. No.; and EPA Est. No. and Code.

OBJECTIVE 13

Optional Activities/
Resources in
Instructor's Guide

Define fertilizer ratio.

Fertilizer ratio is the relative amounts of nitrogen (N), phosphorous (P_2O_5), and potassium (K_2O) in fertilizers. The ratios of NPK are always given in that order in a fertilizer.

EXAMPLES: A fertilizer which has equal percentages of NPK, such as 10-10-10, has a 1-1-1 ratio; a fertilizer such as a 5-10-20 has a 1-2-4 ratio.

OBJECTIVE 14

Optional Activities/
Resources in
Instructor's Guide

Discuss the percent nutrient value of specified fertilizers.

WORDS YOU SHOULD KNOW

complete fertilizers	fertilizers which contain all three primary nutrients
conditioners	used in fertilizers to improve the quality and make the fertilizer easier to use
fertilizer analysis	a list of the fertilizer elements and their percent content; may include any of the 13 mineral elements
filler	sand, clay granules, ground limestone, or other substances that are used as a carrier for the nutrients
mixed fertilizer	a fertilizer that contains two or three nutrients
single-grade fertilizer	a fertilizer containing only one nutrient

☑ **NOTE:** Phosphorus may be referred to as phosphate or phosphoric acid and potassium may be referred to as potash in fertilizers.

- The fertilizer grade indicates the primary nutrient content of the fertilizer. The grade lists the percentage of nitrogen (N), phosphate (P_2O_5), and potash (K_2O).
- The grade is stated as "N-P-K," which refers to nitrogen, phosphorus, and potassium. The nutrients are always listed in that order.
- A fertilizer with a grade of 20-10-10 is 20% nitrogen, 10% phosphoric acid, and 10% potash.
- The remaining percentage of the fertilizer is mainly the weight of the other elements that are part of the carrier, such as hydrogen and oxygen. Fillers and conditioners make up a small percentage of the fertilizer.

OBJECTIVE 15

Optional Activities/
Resources in
Instructor's Guide

Complete a chart on the most desirable pH scale range for crops.

Crop	pH Range
Crimson clover, vetch	5.5-7.0
Peanuts, soybeans	5.8-7.0
Alsike, red, and white clovers	6.0-7.0
Alfalfa, sweet clover	6.2-7.5
Bluestem, fescue, native hay, weeping lovegrass	4.5-7.0
Corn, oats, orchardgrass, ryegrass, sorghum, wheat	5.5-7.0
Bermudagrass	5.7-7.0
Barley	6.5-7.0
Cotton	5.7-7.0

☑ **NOTE:** Most crops can tolerate a range slightly above or below the pH indicated but production may be reduced.

OBJECTIVE 16

Optional Activities/
Resources in
Instructor's Guide

Select from a list the benefits of a liming program.

☑ **NOTE:** Liming is done to counteract soil acidity. While many field crops grow best in slightly acid soil, factors such as leaching of exchangeable bases and acid fertilizers may make the soil too acid for ideal growth.

- Raises soil pH
- Increases crop response to fertilizers by improving the uptake of primary nutrients
- Allows the best crop yields from the finances put into fertilizers

- Removes aluminum toxicity and promotes the activities of desirable organisms

  EXAMPLE: The Rhizobia bacteria that fix nitrogen for legumes.

- Supplies calcium to plants

  ☑ **NOTE:** Some limes also supply magnesium; magnesium is important for many acid sandy soils.

OBJECTIVE 17	**Complete Assignment Sheet 1.**
OBJECTIVE 18	**Complete Assignment Sheet 2.**
OBJECTIVE 19	**Complete Assignment Sheet 3.**
OBJECTIVE 20	**Complete Assignment Sheet 4.**
OBJECTIVE 21	**Complete Assignment Sheet 5.**
OBJECTIVE 22	**Complete Assignment Sheet 6.**
OBJECTIVE 23	**Complete Assignment Sheet 7.**
OBJECTIVE 24	**Complete Assignment Sheet 8.**
OBJECTIVE 25	**Complete Job Sheet 1.**

OBJECTIVE 26

Optional Activities/
Resources in
Instructor's Guide

List factors which determine whether or not irrigation is feasible.

WORDS YOU SHOULD KNOW	
aquifers	porous underground rock formations that hold water; aquifers are porous enough to allow water to flow through them to a well, so they can be sources of ground water
consumptive use	the total of the quantity of water transpired by a plant, the water evaporated from the soil, and the water in the plant material

- Availability of an adequate water source

  ☑ **NOTE:** The amount and the quality of water must be considered.

- Plant use of water (consumptive use)
- Topography
- Labor available
- Crops to be grown
- Soil characteristics
- Capital and maintenance costs
- Energy requirements
- Cost of land preparation
- Economical benefit from the irrigation (crop yields and price)

OBJECTIVE 27

Optional Activities/
Resources in
Instructor's Guide

Match types of irrigation systems to their descriptions.

WORDS YOU SHOULD KNOW	
subsurface irrigation	watering from below; irrigation is done by raising the localized water table; water is applied by open ditches or buried pipes that flow into the water table to raise it to the root zone level
surface irrigation	irrigation by flooding the soil surface with water released from canals or piping systems

- **Flood irrigation** – covering a field with several inches or centimeters of water at one time
- **Furrow irrigation** – water flows by gravity from a main ditch and down the furrows, generally between each two rows of crops

  ☑ **NOTE:** Furrow irrigation is the oldest form of irrigation.

- **Corrugation irrigation** – narrow and closely spaced furrows are made on contours across a field; water soaks into the soil along the furrows
- **Border irrigation** – narrow strips of land are leveled across the slope and a low ridge is built up and down the slope to hold water; each strip is irrigated by flooding
- **Sprinkler irrigation** – overhead application of water in simulated rainfall

  ☑ **NOTE:** Sprinkler irrigation can be used where surface irrigation is not practical because of topography or soil conditions. Sprinkler systems come in various shapes, sizes, and kinds. Sprinkler systems can be either stationary or mobile. The center-pivot system is a self-propelled, continuously moving lateral that rotates around a center pivot well. Center-pivot systems are generally used on larger acreages.

- **Trickle irrigation** – frequent, slow application of water through plastic tubing at low water pressure; water drips from emitters (outlets) at intervals along the delivery lines

  ☑ **NOTE:** Trickle irrigation systems use less water than other systems because of lower distribution and evaporation losses. Trickle systems can be used on steep slopes. These systems are often used on orchards and provide good control of water application.

- **Surge irrigation** – intermittent application of water to furrows in surges

  ☑ **NOTE:** The furrow stream advances faster under surge irrigation and allows more uniform application of water. Surge irrigation minimizes deep percolation of water at the head of the furrow and better wets the soil at the end of the furrow. This system has efficient water use.

OBJECTIVE 28

Optional Activities/
Resources in
Instructor's Guide

Explain the principles of fertigation.

WORDS YOU SHOULD KNOW	
chemigation	the application of any chemical in irrigation systems

- Fertigation is the application of fertilizers through irrigation systems. Fertigation is most efficient when used in sprinkler or trickle irrigation, but can be used with surface irrigation systems. Fertigation will only be as efficient and uniform as the irrigation system.

- The principle nutrients supplied by fertigation are nitrogen (N) and sulfur (S).

  ☑ **NOTE:** Certain fertilizers do not work well when applied through fertigation. Fertilizers applied through fertigation should dissolve and stay in solution and not present a corrosive hazard to the irrigation system.

- Advantages of fertigation include:
    - ☐ application of nutrients close to the time the plants have the greatest need for them

      EXAMPLE: Corn has two periods of high N uptake; during vegetative growth stages and during reproductive growth.
    - ☐ elimination of one or more field operations

OBJECTIVE 29 **Complete Assignment Sheet 9.**

OBJECTIVE 30 **Complete Assignment Sheet 10.**

ASSIGNMENT SHEET 1

FERTILIZERS AND IRRIGATION

B-3

Name ______________________ Score __________

OBJECTIVE 17

Collect plants with fertilizer deficiencies.

EQUIPMENT AND SUPPLIES

- Various plants with fertilizer deficiencies

INSTRUCTIONS

Review objective 10 for symptoms of nutrient deficiency. Collect five plants showing symptoms of nutrient deficiencies and answer the following questions.

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

General Science
- Collect specimens

Life Science
- Identify/classify living organisms

Cognitive Activities
- Draw conclusions

Plant #1

1. Plant name ______________________________
2. Symptoms of deficiencies ______________________________

   ____

   ____

   ____
3. Possible cause of deficiencies ______________________________

   ____

   ____

   ____
4. Recommended treatment ______________________________

   ____

   ____

   ____

Plant #2

1. Plant name ______________________________

2. Symptoms of deficiencies ______________________________

____

____

____

3. Possible cause of deficiencies ______________________________

____

____

____

4. Recommended treatment ______________________________

____

____

____

Plant #3

1. Plant name ______________________________

2. Symptoms of deficiencies ______________________________

____

____

____

3. Possible cause of deficiencies ______________________________

____

____

____

656

4. Recommended treatment ______

Plant #4

1. Plant name ______
2. Symptoms of deficiencies ______
3. Possible cause of deficiencies ______
4. Recommended treatment ______

Plant #5

1. Plant name ______
2. Symptoms of deficiencies ______

3. Possible cause of deficiencies ______________________

____

____

____

4. Recommended treatment ______________________

____

____

____

658

ASSIGNMENT SHEET 2

FERTILIZERS AND IRRIGATION

B-3

Name ________________________________ Score __________

OBJECTIVE 18

Calculate least-cost fertilizer material.

EQUIPMENT AND SUPPLIES

- Fertilizer grade and/or analysis labels for three different fertilizers
- Price labels of the three fertilizers
- Price per ton of N, P_2O_5, and K_2O

INTRODUCTION

Determining which fertilizer to use commonly depends on the price per pound of nutrients supplied. The cost per pound of nutrients in straight fertilizers can be calculated using the following formula.

$$\frac{\text{price/ton}}{\text{\% nutrient X 20}} = \text{cost/lb. of nutrient}$$

If the cost per pound of N, P_2O_5, and K_2O in straight fertilizers has been determined, their relative cost in mixed fertilizers can be compared using the following formula.

$$(\%\text{N X cost/lb. N}) + (\%P_2O_5 \text{ X cost/lb. } P_2O_5) + (\%K_2O \text{ X cost/lb. } K_2O) = \text{cost/100 lb. X 20} = \text{cost/ton}$$

INSTRUCTIONS

Math Application
- Select/apply mathematical procedure

Cognitive Activities
- Draw conclusions
- Evaluate alternatives
- Select an alternative

Using the three fertilizer labels provided by your instructor, calculate the least costly fertilizer. Write your answers in the space provided.

1. Cost of fertilizer #1

2. Cost of fertilizer #2

3. Cost of fertilizer #3

4. Which fertilizer is the least costly? Why?

____

____

____

ASSIGNMENT SHEET 3

FERTILIZERS AND IRRIGATION

B-3

Name ______________________ Score __________

OBJECTIVE 19

Calculate number of pounds of NPK available from different fertilizer analyses.

INTRODUCTION

To determine the amount of nutrient in a fertilizer bag, multiply the percentage of the nutrient by the weight of the fertilizer. For example, a fertilizer with the grade of 46-0-0 is 46% nitrogen with no phosphate or potash. One bag of the fertilizer weighing 100 pounds contains the following amount of potash:

Potash = 100 pounds x 46% = 46 pounds

INSTRUCTIONS

Math Application
- Select/apply mathematical formula

Calculate the number of pounds of NPK available for the following fertilizer analyses.

1. A 50 pound bag of 20-10-10

2. A ton of 5-15-30

3. A 100 pound bag of 20-10-5

4. A 100 pound bag of 82-0-0

5. A 50 pound bag of 18-46-0

ASSIGNMENT SHEET 4

FERTILIZERS AND IRRIGATION

B-3

Name ______________________________ Score __________

OBJECTIVE 20

Calculate the cost per pound of nitrogen for different fertilizer analyses.

INTRODUCTION

Fertilizers should be compared on the cost per pound of nutrients not the cost per ton of material. To determine the cost per pound of N, P_2O_5, or K_2O in straight fertilizer material, use the following formula:

$$\frac{\text{Price/ton}}{\%\text{ nutrient} \times 20} = \text{cost/lb of nutrient}$$

INSTRUCTIONS

Math Application

- Select/apply mathematical formula

Compare the cost per pound of actual nitrogen for each fertilizer. Ask your instructor for the local price per ton on each analysis.

1. Ammonium nitrate 33.0% Local price per ton ________

2. Anhydrous ammonia 82.0% Local price per ton ________

3. Urea 45.0% Local price per ton ________

4. Ammonium sulfate 21.0% Local price per ton ________

ASSIGNMENT SHEET 5

FERTILIZERS AND IRRIGATION

B-3

Name ________________________________ Score ____________

OBJECTIVE 21

Determine fertilizer application rates, yield, and estimated return.

EQUIPMENT AND SUPPLIES

- NPK$PLUS software program and instruction book
- Soil test and crop information

INTRODUCTION

The software program NPK$PLUS helps the user interpret soil tests and select fertilizer application rates. One application of the software interprets the user's soil test results for a specific field. The program also enables the user to calculate yield and estimated return for a specific fertilizer application. The most profitable application rate of fertilization varies each year because of factors such as weather, crop prices, and fertilizer prices.

INSTRUCTIONS

Research and Reference

- Use in-book reference tools
- Use computer data base

Check with your instructor for specific instructions on how to use the software. Then, using the soil test and crop information supplied by your instructor follow the instructions below. Refer to the software instruction book for further detail and guidance. Write any information/answers on a separate sheet of paper.

1. Select Option A: Interpret Soil Test for One Field.
2. Enter the crop and soil test information on the first data-entry screen.
3. Enter fertilization and yield history for the field on the second data-entry screen.
4. Enter cost and market information on the third data-entry screen.
5. End the editing process by pressing the <F10> key. The software program will start calculating.
6. Print out or write down the results of the calculations. Pay special attention to the fertilizer requirements for maximum yield and the percent return.

7. Return to the main menu and select Option A again. This time, on data-entry screen one (crop and soil information) increase the yield goal (bushels/acre) by 25% and run the program again. Also, run the program with the yield goal decreased by 25%. How does this affect the final results of the program?

8. Return to the main menu and select Option B: Calculate Yield and Estimated Return for a Specific Fertilizer Application.

9. Enter the data for the specific application rate.

10. After you have made the entries press the <F10> key.

11. Print out or write down the results of the program. Pay special attention to the yield and percent return. Is the specific fertilizer application rate a viable option?

ASSIGNMENT SHEET 6

FERTILIZERS AND IRRIGATION

B-3

Name ______________________________ Score __________

OBJECTIVE 22

Make a fertilizing schedule.

INTRODUCTION

Fertilizer may be applied before a crop is planted, at the time of planting, after the crop is growing, or a combination of the three methods. Fertilizing before planting brings the soil to a good nutrient level and may supply all of the needed nutrients. The problems with application of fertilizer before a crop is planted are that phosphate is not concentrated near the young seedling, nitrogen may be leached away in some soils, and the fertilizer application does not match the periods when the plant needs the fertilizer most, such as during rapid growth.

Applying fertilizer at the time of planting allows phosphate to be placed near the seed. Fertilizing after planting allows nitrogen to be available and allows the grower to match the needs of the crop.

INSTRUCTIONS

Research and Reference
- Select useful resources
- Locate resources

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Compose reports

Cognitive Activities
- Analyze/synthesize information
- Draw conclusions

Choose one crop that is grown in your area and make a fertilizing schedule for that crop. You will need to do some research on the crop, such as how and when the crop is planted and when the crop is likely to need additional fertilizer (such as rapid growing periods). You may need to consult reference materials, magazines, extension publications, or conduct personal interviews with individuals who are knowledgeable about your chosen crop. Write a one-page report on your findings, and outline the best times for the crop to be fertilized and the appropriate application methods that could be used.

ASSIGNMENT SHEET 7

FERTILIZERS AND IRRIGATION

B-3

Name ______________________________ Score __________

OBJECTIVE 23

Compare organic and inorganic fertilizing methods and costs.

INSTRUCTIONS

Choose an organic method of fertilizing, such as the application of animal manure or sludge, and compare it to inorganic fertilizing methods. Remember to consider factors such as equipment needed, amount of nutrients contained in the fertilizer, and labor costs of collection and application. Also consider such factors as whether or not the farmer has access to the organic fertilizer (for example, animal manure) or must purchase the fertilizer. Answer the questions below.

Research and Reference
- Select useful resources
- Locate resources

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

Cognitive Activities
- Analyze/synthesize information
- Draw conclusions

1. What is the type of organic fertilizer?

____

2. What is the type of inorganic fertilizer?

____

3. What equipment is needed to apply the organic fertilizer?

____

____

4. What equipment is needed to apply the inorganic fertilizer?

____

____

5. What is the cost per pound of nutrients in the organic fertilizer?

____

____

____

6. What is the cost per pound of nutrients in the inorganic fertilizer?

7. What labor costs are involved in the organic fertilizer?

8. What labor costs are involved in the inorganic fertilizer?

9. What possible harmful affects are associated with the organic fertilizer and with the inorganic fertilizer?

10. What type of fertilizer do you think is the best choice? Why?

ASSIGNMENT SHEET 8

FERTILIZERS AND IRRIGATION

B-3

Name ______________________________ Score __________

OBJECTIVE 24

Determine application rate.

INTRODUCTION

To calculate application rates, determine pounds of nutrient needed and then divide by the percent of nutrient in the fertilizer.

EXAMPLE:

$$\frac{\text{40 lbs of } K_2O \text{ needed}}{\text{50 percent } K_2O \text{ in fertilizer}} = \text{80 lbs of 0-0-50 needed per acre}$$

INSTRUCTIONS

Math Application
- Select/apply mathematical procedure

Determine the amount of nutrients needed using the different fertilizer analyses shown below.

1. A farmer desires to plant wheat with a 0-0-20 analysis at a rate of 100 lbs per acre. How many pounds of fertilizer would be needed?

2. How many pounds of 0-0-60 would be needed to apply 40 lbs of K_2O per acre?

3. How many pounds of 82-0-0 would be needed to apply 100 lbs of N per acre?

ASSIGNMENT SHEET 9

FERTILIZERS AND IRRIGATION

B-3

Name ______________________________ Score __________

OBJECTIVE 29

Calculate water needs.

INTRODUCTION

Soil texture and rooting depth are the two factors that affect the amount of water to be applied during irrigation. Different soil textures hold different amounts of water. The following table shows available water for different soil textures at field capacity. An inch of water equals the amount that would cover the soil surface one inch.

Soil Texture	Available Water per Foot of Soil
Sand	0.6
Find sand	1.1
Sandy loam	1.3
Fine sandy loam	1.7
Loam	2.0
Silt loam	2.4
Sandy clay loam	2.4
Clay loam	2.0
Silty clay loam	1.7
Clay	1.5

The average rooting depth for several crops is given below. Rooting depth will vary for different conditions.

Crop	Average Rooting Depth (feet)
Pasture	1-2
Corn	2-3
Grains	2-3
Alfalfa	5-8
Cotton	3-4

To calculate the amount of water to be applied in one irrigation determine the soil texture and rooting depth, then calculate the total water available to the plant by multiplying the root depth by available water. Irrigation should be turned on when 50% of the available water is gone; this means that 50% of the water must be replaced.

INSTRUCTIONS

Math Application
- Select/apply mathematical procedure

Calculate the amount of water to be applied in one irrigation for the problems below. Use the greatest rooting depth for the calculations.

1. Calculate the amount of water to be added for corn in a sandy loam soil.

2. Calculate the amount of water to be added for grains in a sandy clay loam.

3. Calculate the amount of water to be added for pasture in a silty clay loam.

ASSIGNMENT SHEET 10

FERTILIZERS AND IRRIGATION

Name ______________________________ Score __________

OBJECTIVE 30

Determine when to irrigate.

EQUIPMENT AND SUPPLIES

- Soil samples from various fields

INTRODUCTION

Determining when to irrigate can be done using a feel test similar to ribbon testing. A sample of soil is taken from several inches below the surface. The soil is then squeezed in the hand and observed for formation of a stable ball. Use the table below to determine degree of moisture in the soil. When the soil reaches "fair," irrigation should begin.

Moisture	**Feel of the Soil**
Dry	Dry, powdery
Low	Crumbly and will not form a ball
Fair	Somewhat crumbly but will form a ball
Good	Forms a ball and sticks together with pressure
Excellent	Pliable ball can be formed
Too wet	Water can be squeezed out of the ball

☑ **NOTE:** Tensiometers (moisture meters) tell the exact soil moisture and take the guesswork out of irrigation. Another way to determine when to irrigate is to observe the wilting patterns of the plants.

INSTRUCTIONS

Earth Science

- Investigate physical characteristics of the earth

Cognitive Activities

- Analyze/synthesize information
- Draw conclusions

Your instructor will give you five soil samples. Determine the feel of the soil and try to form a ball. Determine if the soil should be irrigated. Write your conclusions in the blanks provided.

1. Soil sample #1

   ____

   ____

   ____

2. Soil sample #2

   ____

   ____

   ____

3. Soil sample #3

   ____

   ____

   ____

4. Soil sample #4

   ____

   ____

   ____

5. Soil sample #5

   ____

   ____

   ____

JOB SHEET 1

FERTILIZERS AND IRRIGATION

B-3

Name ____

OBJECTIVE 25 **Apply fertilizer.**

EQUIPMENT AND SUPPLIES

- Fertilizer
- Application equipment
- Protective clothing and equipment, if necessary
- Area to be fertilized

PROCEDURE

Reading Comprehension
- Gain factual information

Job Acquisition/ Development
- Master specific job task/procedure

	Yes	No
1. Determine the appropriate fertilizer to be applied.	____	____
☑ **NOTE:** The best way to determine the nutrients the soil needs is to have the soil tested.		
2. Determine the appropriate application method.	____	____
EXAMPLES: Broadcasting, side-dressing, foliar		
3. Read the fertilizer label and follow manufacturer's recommendations.	____	____
4. Calculate the application rates.	____	____
5. Put on any necessary protective clothing and equipment.	____	____
6. Apply the fertilizer with the chosen application method.	____	____

SKILL TEST RECORD

EVALUATOR'S COMMENTS

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Safety followed	4	3	2	1
Determined fertilizer	4	3	2	1
Determined application	4	3	2	1
Correctly applied	4	3	2	1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

4 **Skilled** – Can perform job with no additional training.
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
1 **Unskilled** – Is familiar with process, but is unable to perform job.

EVALUATOR'S COMMENTS

OBJECTIVE SHEET

SOIL CONSERVATION PRACTICES

B-4

INTRODUCTION

Soil conservation is vital to preserve the natural resource of soil and ensure that the soil can remain productive for many years. Soil loss occurs through erosion and can range from slight to very severe. Soil erosion produces sediment which is a pollutant and can contaminate water. Proper management practices and erosion control methods can greatly reduce the loss of soil through erosion. Understanding and implementing soil conservation practices benefit both the land owner and the farmer, and helps preserve the environment.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS

PREREADING:	Read *Wetlands Determinations, Definitions, and Management Options*, OSU CR-876.
WRITING:	Write a short essay on wetlands. Include a discussion of your opinion on why it is important to properly manage wetland areas.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Describe the effects of wind and water erosion.
2. Match degrees of erosion to their correct definitions.
3. Match categories of water erosion to their correct definitions.
4. List management practices that aid in water erosion control.
5. Select from a list management practices that control wind erosion.
6. Describe benefits of artificial drainage.
7. Define conservation tillage.
8. Explain the principles of conservation tillage.
9. Determine degrees of erosion. (Assignment Sheet 1)
10. Determine ways to stop soil erosion. (Assignment Sheet 2)

INFORMATION SHEET

SOIL CONSERVATION PRACTICES

B-4

OBJECTIVE 1

Optional Activities/
Resources in
Instructor's Guide

Describe the effects of wind and water erosion.

- Erosion removes topsoil which provides the best growing medium for plants.

- When the topsoil is eroded, much of the soil's organic matter and plant nutrients such as nitrogen and phosphorus are lost.

- Erosion causes the soil profile to become thinner and decreases the root zone. This also causes the soil to lose water-holding capacity.

- Severe erosion, such as gullies, removes a large amount of soil, and makes it difficult or impossible to operate farm equipment over the eroded areas.

- Eroded soil pollutes rivers, lakes, and streams with nutrients and pesticides which can adversely affect the biological activity in and around the water.

  ☑ **NOTE:** Water which has become polluted can contaminate and even kill large numbers of aquatic life, such as fish. This not only adversely affects the biological activity of the water but also impacts people who may depend on the water as a source of food. For example, tourist activity from fishing in local streams.

- Soil sediment from erosion settles in streams, lakes, harbors, and reservoirs. This sediment causes problems such as creating the need for dredging to clear harbors and waterways, reducing the ability of streams to carry water which increases the likelihood of flooding, and causing reservoirs to hold less water because of the sediment buildup.

OBJECTIVE 2

Optional Activities/ Resources in Instructor's Guide

Match degrees of erosion to their correct definitions.

- **None to slight** – degree of erosion in which less than 25 percent of the surface soil has been removed, with no gullies, and with a plow layer that exhibits characteristics of the A horizon
- **Moderate** – degree of erosion in which 25 to 75 percent of the surface soil has been removed, with or without gullies, and with a plow layer that consists of a mixture of the surface A horizon and underlying B horizon
- **Severe** – degree of erosion in which 75 percent or more of the surface soil has been removed, with occasional uncrossable gullies more than 100 feet apart and/or severe accumulation by wind, and with a plow layer that exhibits predominantly B horizon characteristics
- **Very severe** – degree of erosion in which 75 percent or more of the surface soil has been removed, with frequent uncrossable gullies less than 100 feet apart and/or severe accumulation by wind, and with a plow layer that exhibits characteristics similar to severely eroded soil

OBJECTIVE 3

Optional Activities/ Resources in Instructor's Guide

Match categories of water erosion to their correct definitions.

- **Splash erosion** – soil is directly moved by a raindrop splash

- **Sheet erosion** – the removal of a relatively uniform thin layer of soil (Figure 1)

FIGURE 1

- **Rill erosion** – surface runoff water accumulates into small channels on slopes; a rill can be filled in by tillage (Figure 2)

FIGURE 2

- **Gully erosion** – surface runoff water accumulates in channels that become deeper and wider; gullies cannot be crossed by farm equipment (Figure 3)

FIGURE 3

- **Streambank erosion** – erosion that occurs when the banks of a stream erode because of flowing water

☑ **NOTE:** Streambank erosion is not that significant in crop production. Small amounts of cropland can be lost when fields border streams.

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

List management practices that aid in water erosion control.

WORDS YOU SHOULD KNOW	
contour farming	farming in which the tillage follows the contour of a slope, rather than going up and down the slope
diversions	large-capacity terraces that divert water runoff from higher elevations; diversions are covered with grass and are not farmed
strip cropping	the practice of planting different types of crops in alternate strips; strips are generally planted on a slope contour or across the direction of the prevailing wind
terraces	raised or level strips of land on a slope

- Conservation tillage
- Crop rotation
- Planting cover crops

  ☑ **NOTE:** Planting vegetative cover is one of the most effective means of preventing erosion.

- Providing waterways
- Contour farming
- Strip-cropping
- Terraces
- Improving organic matter
- Diversions

  ☑ **NOTE:** For information and assistance in preventing erosion in specific areas contact your local conservation district office or county extension office.

OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Select from a list management practices that control wind erosion.

WORDS YOU SHOULD KNOW	
mulch	a covering containing straw, compost, etc. that is spread on the soil to help prevent erosion

- Conservation tillage
- Planting windbreaks of trees and large shrubs
- Keeping soil covered with vegetation or mulch

  ☑ **NOTE:** For information and assistance in preventing erosion in specific areas contact your local conservation district office or county extension office.

OBJECTIVE 6

Optional Activities/
Resources in
Instructor's Guide

Describe benefits of artificial drainage.

WORDS YOU SHOULD KNOW	
artificial drainage	the removal of surplus water of the soil by open ditches or subsurface conduits

- Artificial drainage allows soils to be more productive.
  - ☐ Allows wet soils, which are generally the most fertile, to be used for productive purposes.
  - ☐ Increases crop yields

    ☑ **NOTE:** Soils warm earlier in the spring which allows for earlier planting, longer growing seasons, and increased yields.

  - ☐ Land is adapted to a wider variety of crops.
  - ☐ Proper drainage makes the field more uniform in soil moisture allowing for better planning and management of tillage, planting, and harvesting operations.

- Artificial drainage increases nutrients available and decreases damage to plants.
  - Allows for deeper penetration of plant roots, which increases the amounts of nutrients available to plants

    ☑ **NOTE:** Artificial drainage increases uptake of phosphorus, potassium, and most other nutrients.

  - Decreases damage to plant roots and plants from frost heaving and drought

    ☑ **NOTE:** Deeper rooting helps decrease drought damage.

  - Reduces mosquito and fly populations
  - Decreases weed infestation
  - Decreases incidence of crop diseases such as root rots
  - Reduces the accumulation of toxic substances in the soil

    EXAMPLES: Soluble salts, sulfides

- Artificial drainage improves the soil.
  - Improves aeration
  - Increases earthworm activity which creates more holes in the soil which allows more oxygen for plant roots
  - Improves soil structure
- Artificial drainage decreases surface water runoff and the resulting soil erosion

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

Define conservation tillage.

WORDS YOU SHOULD KNOW	
conventional tillage	farming practice in which residues are burned or buried and a fine, pulverized seedbed is used for planting
fallow	land which is left without a crop for a period of several months to a year; all weeds or other plants are killed
no-till	a practice in which tillage is used only to insert seed and fertilizer into a slit in the soil
reduced tillage	any tillage operations which do less tillage than "conventional" tillage
ridge-till	method in which crops are planted in a cleaned strip; the seeds are planted on a six-to-eight inch high ridge created by the previous year's cultivation
strip till	tillage of only strips of soil, leaving non-tilled strips between; the tilled strip is used as a seedbed, allowing placement of seed and fertilizer; the untilled strips are left as protective strips between the planted areas

Conservation tillage refers to tillage practices that provide for control of wind and water erosion partially by managing crop residues. At least 30 percent of the soil surface is covered by plant residues to control water erosion.

OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

Explain the principles of conservation tillage.

- Conservation tillage reduces soil erosion.
- Instead of plowing under crop residues, some or even all of the crop residue is left on the soil surface. A field under conservation tillage has at least 30 percent of the soil surface covered by crop residues.
- The type of conservation tillage used for a particular field depends on factors such as crops grown, soil characteristics, and climate.

OBJECTIVE 9 **Complete Assignment Sheet 1.**

OBJECTIVE 10 **Complete Assignment Sheet 2.**

ASSIGNMENT SHEET 1

SOIL CONSERVATION PRACTICES

B-4

Name ______________________ Score __________

OBJECTIVE 9

Determine degrees of erosion.

INSTRUCTIONS

Read each of the case studies below and calculate the percent of erosion that has taken place on each field. Show your work in the space provided and then write an "X" in the blank beside the answer that indicates the correct degree of erosion for that field.

Reading Comprehension
- Gain factual information

Math Application
- Solve percent problems

Earth Science
- Investigate physical characteristics of the earth
- Investigate conservation of physical resources

EXAMPLE: The field has a plow layer that exhibits characteristics of the A horizon, no uncrossable gullies, and the current topsoil depth measures at 10 inches. Records indicate that the original topsoil depth was 12 inches. What is the percent of erosion that has taken place, and which of the following is the correct degree of erosion in this field?

Original topsoil = 12"
Lost topsoil = 2"

2 ÷ 12 = 1 ÷ 6 = .17 = 17%

Percent of erosion = 17%

Degree of erosion =

X a. None to slight ______ c. Severe

______ b. Moderate ______ d. Very severe

1. In Field #1 there is one uncrossable gully, a plow layer that exhibits predominately B-horizon characteristics, and a topsoil depth that measures at 3 inches. Records indicate that the original topsoil depth was 14 inches. What is the percent of erosion that has taken place, and which of the following is the correct degree of erosion in this field?

Percent of erosion = ________________________________

Degree of erosion =

_____ a. None to slight _____ c. Severe

_____ b. Moderate _____ d. Very severe

2. Field #2 has a sandy topsoil, very slow permeability, a plow layer that consists of a mixture of A horizon and B horizon, a topsoil depth that measures at 5 inches, and no uncrossable gullies. Records indicate that the original topsoil depth was 15 inches. What is the percent of erosion that has taken place, and which of the following is the correct degree of erosion in this field?

Percent of erosion = ______________________________

Degree of erosion =

_____ a. None to slight _____ c. Severe

_____ b. Moderate _____ d. Very severe

3. Field #3 has been used as a recreational area for dune buggies. The plow layer exhibits predominately B horizon characteristics and the sandy topsoil has been measured at a depth of 2 inches. There are several very severe gullies in the field and several sand dunes have been created by the wind. Records indicate that the original topsoil depth was 10 inches. What is the percent of erosion that has taken place, and which of the following is the correct degree of erosion in this field?

Percent of erosion = ______________________________

Degree of erosion =

_____ a. None to slight _____ c. Severe

_____ b. Moderate _____ d. Very severe

ASSIGNMENT SHEET 2

SOIL CONSERVATION PRACTICES

B-4

Name ______________________ Score __________

OBJECTIVE 10 **Determine ways to stop soil erosion.**

INSTRUCTIONS

In this Assignment Sheet, you will determine ways to stop soil erosion. Your instructor will specify the sites for you to analyze. Answer the following questions for each site.

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Earth Science
- Investigate physical characteristics of the earth
- Investigate conservation of physical resources

Cognitive Activities
- Analyze/synthesize information

1. What is the condition of the field?

2. Identify and describe areas that may be likely to erode.

3. Are there any erosion control methods currently on the field? Explain.

4. Are the erosion control methods appropriate? Explain.

5. What other erosion control methods could be used on the field?

OBJECTIVE SHEET

LAND USES AND CLASSIFICATION

C-1

INTRODUCTION

All land is not the same. Some land is better suited to certain purposes than other land. Land classification helps people determine the best possible use of land. It is important for people in agriculture to understand land uses and classifications. Land that is properly used will be more productive. Properly using land also ensures that the land will be useful in the future.

PREREQUISITE

Unit B-1 "Soils," *Soil, Plant, and Crop Science*

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS

PREREADING:	Read OSU Fact Sheet No. F-808, *Environmental Regulations Affecting Land Use.*
WRITING:	Write a short essay on environmental regulations affecting land use. Include a discussion of your opinion on environmental regulations.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Name reasons for judging land.
2. List factors that determine land capability class.
3. Match degrees of permeability to their correct soil characteristics.
4. Match rates of surface runoff to their correct definitions.
5. Match land capability classes to their correct definitions.
6. Complete a chart on correct suitable uses of land capability classes.
7. Complete a chart on the best land capability class possible for certain soil factors.
8. List recommended land treatments applied to land capability classes.
9. Match types of vegetative practices to the correct land capability classes each is applied to.
10. Match types of mechanical treatments to their correct uses.
11. Match factors that affect land capability class to the correct land treatments applied to each.
12. Complete a land judging score card when given the characteristics of a field. (Assignment Sheet 1)
13. Judge a field and complete the score card. (Assignment Sheet 2)

LAND USES AND CLASSIFICATION

OBJECTIVE 1

Optional Activities/
Resources in
Instructor's Guide

Name reasons for judging land.

WORDS YOU SHOULD KNOW	
land capability classes	the United States Department of Agriculture's classification system developed to define the degrees of suitability and limitations for land use that will keep the soil permanently productive

- To understand basic soil differences and how they affect crop production.
- To understand different soil and water conservation practices.
- To understand the influence of land features on production and land protection.
- To determine management practices important to proper use of soil and water.

  EXAMPLE: Management practices to reduce erosion by water and/or wind.
- To determine land capability classes.

OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

List factors that determine land capability class.

WORDS YOU SHOULD KNOW

erosion	soil loss by water or wind
slope	the number of feet of rise or fall to each 100 feet of horizontal distance
soil permeability	the ease in which air and water are able to go down into a soil and return back toward the surface
surface runoff	the relative rate water is removed by flow over a soil's surface

- Soil texture
- Depth of soil
- Slope
- Erosion
- Soil permeability
- Surface runoff

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

Match degrees of permeability to their correct soil characteristics.

☑ **NOTE:** All permeabilities are taken from the subsoil.

- **Rapid permeability** – soils that have loose or open sandy subsoils
- **Moderate permeability** – soils that have highly granular, blocky, or columnar clay loam subsoils
- **Slow permeability** – soils that have clayey subsoils and are medium, blocky, to somewhat crumbly
- **Very slow permeability** – soils that have dense, fine clay, or claypan subsoils with a plate-like, coarse, blocky, or massive structure

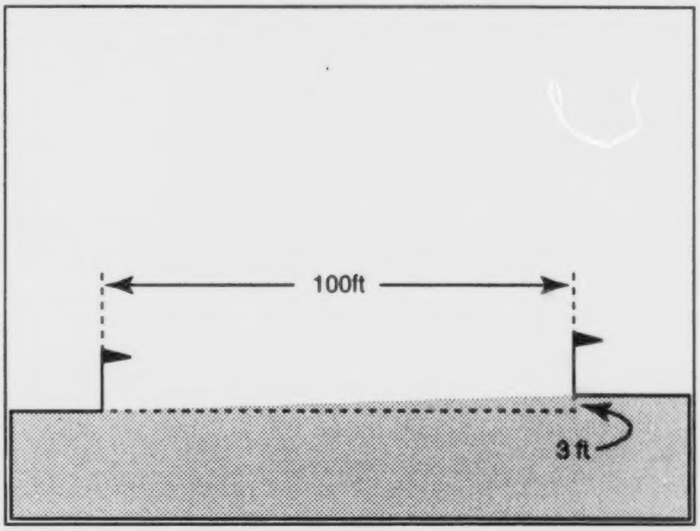
OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Match rates of surface runoff to their correct definitions.

- **Rapid** – surface water flows rapidly over the surface of fields with a slope of 3 percent or above, except for rapidly permeable soils (Figure 1)

FIGURE 1



☑ **NOTE:** Fields that have rapid surface runoff lose a substantial amount of rainfall which increases the hazards associated with erosion and drought conditions.

- **Moderate** – surface water flows away at what is considered a normal rate over fields with slopes of 1 to 3 percent (except for rapidly permeable soils)

- **Slow** – surface water flows away slowly

☑ **NOTE:** Fields that are considered to have slow surface runoff include nearly level areas with moderately permeable subsoils or nearly level, slowly permeable sandy soils. On a field with slow surface runoff with clayey soil, surplus water will occasionally be a problem.

- **Very slow** – surface water flows away very slowly and soil may remain wet for long periods of time

☑ **NOTE:** Fields that are considered to have very slow surface runoff have slopes that range from nearly level to concave with deep sandy soils and rapidly permeable subsoil, or they can be nearly level fields with sandy soils and moderate permeability.

OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Match land capability classes to their correct definitions.

- **Class I** – these soils have few limitations and can be used year after year for agricultural production with little treatment and proper agricultural practices

  ☑ **NOTE:** Class I soils are well drained, nearly level, fertile, and have a low risk for erosion.

- **Class II** – these soils have mild limitations and require moderate conservation practices

- **Class III** – these soils have severe limitations and require special conservation practices

- **Class IV** – these soils have very severe limitations and require greater conservation practices

  ☑ **NOTE:** Crops that completely cover the soil, such as hay, or "permanent" crops, such as pastures, may be the best for Class IV soils.

- **Class V** – these soils have little erosion hazard but have other limitations that make them impractical for cultivation

  ☑ **NOTE:** Limitations include such factors as wetness and rockiness; includes flood lands.

- **Class VI** – these soils have severe limitations such as steep slopes or shallow soils and require special management practices

- **Class VII** – these soils have very severe limitations that require careful management to protect the soil

- **Class VIII** – these soils have such severe limitations that they cannot be used for commercial plant production and their use must be extremely limited

  ☑ **NOTE:** Limitations include steep slopes, rocky lands, sandy beaches, and heavily flooded river bottoms. Primarily used for wildlife and recreation.

702

OBJECTIVE 6

Optional Activities/
Resources in
Instructor's Guide

Complete a chart on correct suitable uses of land capability classes.

	Class							
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
Crop production	X	X	X					
Hay	X	X	X	X				
Pasture	X	X	X	X	X	X	X	
Range	X	X	X	X	X	X	X	
Woodland	X	X	X	X	X	X	X	
Wildlife	X	X	X	X	X	X	X	X
Watershed	X	X	X	X	X	X	X	X
Recreation	X	X	X	X	X	X	X	X

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

Complete a chart on the best land capability class possible for certain soil factors.

Land Capability Factor	Soil Factor	Best Land Class
Texture	Coarse	III
	Moderately coarse, medium, moderately fine, fine	I
Depth	Deep, moderately deep	I
	Shallow	III
	Very Shallow	VII
Permeability	Rapid	III
	Moderate, slow	I
	Very slow	II
Slope	Nearly level (0% to 1%)	I
	Gently sloping (1% to 3%)	II
	Moderately sloping (3% to 5%)	III
	Strongly sloping (5% to 8%)	IV
	Steep (8% to 15%), very steep (15% and over)	VI
Erosion	None to slight	I
	Moderate	II
	Severe, very severe	VI
Surface runoff	Rapid	III
	Moderate, slow	I
	Very slow	II

OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

List recommended land treatments applied to land capability classes.

- Vegetative practices
- Mechanical practices
- Fertilizer and lime

☑ **NOTE:** Fertilizer treatments include phosphorous, potassium, and nitrogen. Liming is indicated on soils with a pH of up to and including 6.3. Soils with a pH above 8.0 indicate a salinity problem and require sulfur or a similar amendment. Phosphorous is indicated for soils with phosphorous levels up to 60 lbs/acre. Potassium levels less than 300 lbs/acre indicate treatment. Nitrogen levels are given as adequate or deficient in land judging since sufficiency or deficiency for all crops is not established.

OBJECTIVE 9

Optional Activities/
Resources in
Instructor's Guide

Match types of vegetative practices to the correct land capability classes each is applied to.

Vegetative Practice	**Land Classes**
Row cropping with soil-conserving crop	
Row cropping with occasional soil conserving crop	I
Row cropping with frequent soil conserving crop	II
Row cropping not more than two out of four years	III
Row cropping not more than one out of five years	IV
Returning crop residue to soil	I, II, III, IV
Practicing conservation tillage	I, II, III, IV
Establishing recommended grasses and legumes	V, VI, VII, VIII
Practicing proper pasture and range management	V, VI, VII
Protecting from burning	V, VI, VII, VIII
Practicing control grazing	V, VI, VII
Planting recommended trees	V, VI, VII, VIII
Practicing selective harvesting	V, VI, VII, VIII
Establishing wildlife or recreation areas	VIII

OBJECTIVE 10

Optional Activities/
Resources in
Instructor's Guide

Match types of mechanical treatments to their correct uses.

Mechanical Treatment	Use
Controlling brush and trees	Used on all land capability classes except Class VIII
Terracing and farming on contour	Used on land capability classes II, III, and IV
Maintaining terraces	Used any time terracing and farming on contour are recommended
Constructing diversion terraces	Used whenever field has overhead water problem
Installing drainage system	Used where wetness is a factor
Controlling gullies	Used when active gullies are a problem
No treatment needed	Used when brush and trees, erosion, gullies, drainage, or outside water are not problems

OBJECTIVE 11

Optional Activities/
Resources in
Instructor's Guide

Match factors that affect land capability class to the correct land treatments applied to each.

Factor	Land treatment
Wetness	Installing drainage system
Frequently flooded	No mechanical treatment applies
Overhead water	Constructing diversion terraces
Needs windbreak	Planting recommended trees; protecting from burning
Desires post lot or wood lot	Planting recommended trees; practicing selective harvesting of trees; protecting from burning
Timber production	Planting recommended trees; practicing selective harvesting of trees; protecting from burning

OBJECTIVE 12 Complete Assignment Sheet 1.

OBJECTIVE 13 Complete Assignment Sheet 2.

ASSIGNMENT SHEET 1

LAND USES AND CLASSIFICATION C-1

Name ______________________________ Score __________

OBJECTIVE 12

Complete a land judging score card when given the characteristics of a field.

You will see the video *Land Judging* which will show you how to use the judging score card.

INSTRUCTIONS

Read the case studies below and study the score cards on the following page. Then determine the land capability class of each land site described and select land treatments that would be appropriate to the site. Write an "X" in the square before each correct answer for each category shown on the score card.

Reading Comprehension
- Gain factual information
- Draw conclusions

Functional Reading
- Use content area vocabulary

Functional Writing
- Complete forms and records

Cognitive Activities
- Analyze/synthesize information

1. The surface texture of the soil on this site forms very hard clods when dry but is sticky when wet. The subsoil is a firm clay-loam that when moistened forms a short ribbon as it is squeezed between the fingers. The topsoil is 12 inches deep, the subsoil is 30 inches deep, and the original topsoil depth was 15 inches. There is a 4-foot slope, and the land is terraced and is being farmed on the contour. There are no uncrossable gullies, but there is a hill above the site that creates an overhead water problem. Soil tests indicate a pH of 7.0, a phosphate level of 57 pounds per acre, a potassium level of 200 pounds per acre, and a nitrogen deficiency.

2. The soil on this site forms very hard lumps or clods when dry and is very sticky when wet. The subsoil appears to be firm clay-loam with medium-blocky, subangular-blocky, and prismatic structures. When squeezed between the fingers, the wet subsoil forms a short ribbon that tends to break or bend downward. The topsoil is 6 inches deep and the subsoil is 28 inches deep. The original topsoil was 10 inches deep. There is a 4-foot-slope, and the land is being terraced and farmed on the contour. There are no uncrossable gullies. Soil tests indicate a pH of 6.0, a phosphate level of 65 lbs/acre, a potassium level of 250 lbs/acre, and a nitrogen deficiency.

3. The topsoil on this site appears to be a mixture of sand, silt, and clay that feels slightly gritty to the touch and, when moistened and squeezed between the fingers, forms a mold that can be handled freely without breaking but will not ribbon. The subsoil is a slightly firm loam that, when squeezed between the fingers, forms a short ribbon. The topsoil depth is 10 inches, the subsoil depth is 24 inches, and the original topsoil was 12 inches deep. There is a 6-inch-slope and no uncrossable gullies. Soil tests indicate a pH of 7.2, a phosphate level of 50 lbs/acre, a potassium level of 300 lbs/acre, and a nitrogen deficiency.

	SOIL FACTORS - PART 1 Check Appropriate Square
SCORE	
	A. Texture Sur. Sub. ☐ ☐ 1. Coarse ☐ ☐ 2. Moderately coarse ☐ ☐ 3. Medium ☐ ☐ 4. Moderately fine ☐ ☐ 5. Fine
	B. Depth of Soil ☐ 1. Deep ☐ 2. Moderately deep ☐ 3. Shallow ☐ 4. Very shallow
	C. Slope ☐ 1. Nearly level ☐ 2. Gently sloping ☐ 3. Moderately sloping ☐ 4. Strongly sloping ☐ 5. Steep ☐ 6. Very steep
	D. Erosion-Wind & Water ☐ 1. None to slight ☐ 2. Moderate ☐ 3. Severe ☐ 4. Very severe
	Interpretations of Soil Factors
	E. Permeability ☐ 1. Rapid ☐ 2. Moderate ☐ 3. Slow ☐ 4. Very slow
	F. Surface Runoff ☐ 1. Rapid ☐ 2. Moderate ☐ 3. Slow ☐ 4. Very slow
	G. Major Factors That Keep Area Out of Class 1 ☐ 1. Texture ☐ 2. Depth ☐ 3. Slope ☐ 4. Erosion ☐ 5. Permeability ☐ 6. Runoff ☐ 7. Wetness ☐ 8. Flooding ☐ 9. None
	H. Land Capability Class ☐ 1. Class I ☐ 2. Class II ☐ 3. Class III ☐ 4. Class IV ☐ 5. Class V ☐ 6. Class VI ☐ 7. Class VII ☐ 8. Class VIII

	RECOMMENDED LAND TREATMENTS PART 2
SCORE	
	A. Vegetative ☐ 1. Row crop/occasional soil conserving crop ☐ 2. Row crop/frequent soil conserving crop ☐ 3. Row crops not more than 2 out of 4 years ☐ 4. Row crops not more than 1 out of 5 years ☐ 5. Return crop residue to the soil ☐ 6. Practice conservation tillage ☐ 7. Establish recommended grass or grasses and legumes ☐ 8. Proper pasture and range management ☐ 9. Protect from burning ☐ 10. Control grazing ☐ 11. Plant recommended trees ☐ 12. Harvest trees selectively ☐ 13. Use only for wildlife or recreation area
	B. Mechanical ☐ 14. Control brush or trees ☐ 15. Terrace and farm on contour ☐ 16. Maintain terraces ☐ 17. Construction diversion terraces ☐ 18. Install drainage system ☐ 19. Control gullies ☐ 20. No mechanical treatment needed
	C. Fertilizer & Soil Amendments ☐ 21. Soil amendments ☐ 22. Phosphorus (P_2O_5) ☐ 23. Potassium (K_2O) ☐ 24. Nitrogen (N) ☐ 25. Fertilizer or soil amendments not needed

	SOIL FACTORS - PART 1 Check Appropriate Square
SCORE	
	A. Texture Sur. Sub. ☐ ☐ 1. Coarse ☐ ☐ 2. Moderately coarse ☐ ☐ 3. Medium ☐ ☐ 4. Moderately fine ☐ ☐ 5. Fine
	B. Depth of Soil ☐ 1. Deep ☐ 2. Moderately deep ☐ 3. Shallow ☐ 4. Very shallow
	C. Slope ☐ 1. Nearly level ☐ 2. Gently sloping ☐ 3. Moderately sloping ☐ 4. Strongly sloping ☐ 5. Steep ☐ 6. Very steep
	D. Erosion-Wind & Water ☐ 1. None to slight ☐ 2. Moderate ☐ 3. Severe ☐ 4. Very severe
	Interpretations of Soil Factors
	E. Permeability ☐ 1. Rapid ☐ 2. Moderate ☐ 3. Slow ☐ 4. Very slow
	F. Surface Runoff ☐ 1. Rapid ☐ 2. Moderate ☐ 3. Slow ☐ 4. Very slow
	G. Major Factors That Keep Area Out of Class 1 ☐ 1. Texture ☐ 5. Permeability ☐ 2. Depth ☐ 6. Runoff ☐ 3. Slope ☐ 7. Wetness ☐ 4. Erosion ☐ 8. Flooding ☐ 9. None
	H. Land Capability Class ☐ 1. Class I ☐ 5. Class V ☐ 2. Class II ☐ 6. Class VI ☐ 3. Class III ☐ 7. Class VII ☐ 4. Class IV ☐ 8. Class VIII

	RECOMMENDED LAND TREATMENTS PART 2
SCORE	
	A. Vegetative ☐ 1. Row crop/occasional soil conserving crop ☐ 2. Row crop/frequent soil conserving crop ☐ 3. Row crops not more than 2 out of 4 years ☐ 4. Row crops not more than 1 out of 5 years ☐ 5. Return crop residue to the soil ☐ 6. Practice conservation tillage ☐ 7. Establish recommended grass or grasses and legumes ☐ 8. Proper pasture and range management ☐ 9. Protect from burning ☐ 10. Control grazing ☐ 11. Plant recommended trees ☐ 12. Harvest trees selectively ☐ 13. Use only for wildlife or recreation area
	B. Mechanical ☐ 14. Control brush or trees ☐ 15. Terrace and farm on contour ☐ 16. Maintain terraces ☐ 17. Construction diversion terraces ☐ 18. Install drainage system ☐ 19. Control gullies ☐ 20. No mechanical treatment needed
	C. Fertilizer & Soil Amendments ☐ 21. Soil amendments ☐ 22. Phosphorus (P_2O_5) ☐ 23. Potassium (K_2O) ☐ 24. Nitrogen (N) ☐ 25. Fertilizer or soil amendments not needed

	SOIL FACTORS - PART 1 Check Appropriate Square
SCORE	
	A. Texture Sur. Sub. ☐ ☐ 1. Coarse ☐ ☐ 2. Moderately coarse ☐ ☐ 3. Medium ☐ ☐ 4. Moderately fine ☐ ☐ 5. Fine
	B. Depth of Soil ☐ 1. Deep ☐ 2. Moderately deep ☐ 3. Shallow ☐ 4. Very shallow
	C. Slope ☐ 1. Nearly level ☐ 2. Gently sloping ☐ 3. Moderately sloping ☐ 4. Strongly sloping ☐ 5. Steep ☐ 6. Very steep
	D. Erosion-Wind & Water ☐ 1. None to slight ☐ 2. Moderate ☐ 3. Severe ☐ 4. Very severe
	Interpretations of Soil Factors
	E. Permeability ☐ 1. Rapid ☐ 2. Moderate ☐ 3. Slow ☐ 4. Very slow
	F. Surface Runoff ☐ 1. Rapid ☐ 2. Moderate ☐ 3. Slow ☐ 4. Very slow
	G. Major Factors That Keep Area Out of Class 1 ☐ 1. Texture ☐ 5. Permeability ☐ 2. Depth ☐ 6. Runoff ☐ 3. Slope ☐ 7. Wetness ☐ 4. Erosion ☐ 8. Flooding ☐ 9. None
	H. Land Capability Class ☐ 1. Class I ☐ 5. Class V ☐ 2. Class II ☐ 6. Class VI ☐ 3. Class III ☐ 7. Class VII ☐ 4. Class IV ☐ 8. Class VIII

	RECOMMENDED LAND TREATMENTS PART 2
SCORE	
	A. Vegetative ☐ 1. Row crop/occasional soil conserving crop ☐ 2. Row crop/frequent soil conserving crop ☐ 3. Row crops not more than 2 out of 4 years ☐ 4. Row crops not more than 1 out of 5 years ☐ 5. Return crop residue to the soil ☐ 6. Practice conservation tillage ☐ 7. Establish recommended grass or grasses and legumes ☐ 8. Proper pasture and range management ☐ 9. Protect from burning ☐ 10. Control grazing ☐ 11. Plant recommended trees ☐ 12. Harvest trees selectively ☐ 13. Use only for wildlife or recreation area
	B. Mechanical ☐ 14. Control brush or trees ☐ 15. Terrace and farm on contour ☐ 16. Maintain terraces ☐ 17. Construction diversion terraces ☐ 18. Install drainage system ☐ 19. Control gullies ☐ 20. No mechanical treatment needed
	C. Fertilizer & Soil Amendments ☐ 21. Soil amendments ☐ 22. Phosphorus (P_2O_5) ☐ 23. Potassium (K_2O) ☐ 24. Nitrogen (N) ☐ 25. Fertilizer or soil amendments not needed

ASSIGNMENT SHEET 2 — LAND USES AND CLASSIFICATION — C-1

Name ______________________________ Score __________

OBJECTIVE 13

Judge a field and complete the score card.

You will review the video *Land Judging* before completing this assignment sheet.

EQUIPMENT AND SUPPLIES

- Fields for judging
- Tools to dig a soil profile
- Flags or stakes

INSTRUCTIONS

Study the following procedures for judging a field. Ask your instructor for specific instructions on selecting a field. After a field has been selected, determine the land capability class, select land treatments, and fill out a score card for the site. Write an "X" in the square before the correct answer for each category.

Procedure for selecting a field for judging:

1. Select the field.
2. Select a representative site within the field; site must be at least 100 feet wide and 100 feet long, but does not have to be a square.
3. Dig a hole to expose the soil profile; the hole should be deep enough to show topsoil, subsoil, and soil depth.
4. Put samples of topsoil and subsoil near the hole.
5. Set flags or stakes to indicate boundary of area to be considered.
6. Set flags or stakes to indicate a 100-foot distance for estimating slope.

Functional Reading
- Follow written instructions

Functional Writing
- Complete forms and records

Earth Science
- Investigate physical characteristics of the earth

Cognitive Activities
- Analyze/synthesize information

7. Provide the following information about the field's condition.

CONDITION OF FIELD
FIELD NO. _____

1. Soil tests show:
   a. pH
   b. Phosphorus _________ lb/acre P_2O_5
   c. Potassium _________ lb/acre K_2O
   d. Nitrogen _________ lb/acre N
   e. Other:
2. Pay no attention to present mechanical practices.
3. Thickness of original topsoil was _________ inches.
4. Size of field is _________ acres.
5. Treat for most intensive use.
6. Other factors:

	SOIL FACTORS - PART 1 Check Appropriate Square
SCORE	
	A. Texture Sur. Sub. ☐ ☐ 1. Coarse ☐ ☐ 2. Moderately coarse ☐ ☐ 3. Medium ☐ ☐ 4. Moderately fine ☐ ☐ 5. Fine
	B. Depth of Soil ☐ 1. Deep ☐ 2. Moderately deep ☐ 3. Shallow ☐ 4. Very shallow
	C. Slope ☐ 1. Nearly level ☐ 2. Gently sloping ☐ 3. Moderately sloping ☐ 4. Strongly sloping ☐ 5. Steep ☐ 6. Very steep
	D. Erosion-Wind & Water ☐ 1. None to slight ☐ 2. Moderate ☐ 3. Severe ☐ 4. Very severe
	Interpretations of Soil Factors
	E. Permeability ☐ 1. Rapid ☐ 2. Moderate ☐ 3. Slow ☐ 4. Very slow
	F. Surface Runoff ☐ 1. Rapid ☐ 2. Moderate ☐ 3. Slow ☐ 4. Very slow
	G. Major Factors That Keep Area Out of Class 1 ☐ 1. Texture ☐ 2. Depth ☐ 3. Slope ☐ 4. Erosion ☐ 5. Permeability ☐ 6. Runoff ☐ 7. Wetness ☐ 8. Flooding ☐ 9. None
	H. Land Capability Class ☐ 1. Class I ☐ 2. Class II ☐ 3. Class III ☐ 4. Class IV ☐ 5. Class V ☐ 6. Class VI ☐ 7. Class VII ☐ 8. Class VIII

	RECOMMENDED LAND TREATMENTS PART 2
SCORE	
	A. Vegetative ☐ 1. Row crop/occasional soil conserving crop ☐ 2. Row crop/frequent soil conserving crop ☐ 3. Row crops not more than 2 out of 4 years ☐ 4. Row crops not more than 1 out of 5 years ☐ 5. Return crop residue to the soil ☐ 6. Practice conservation tillage ☐ 7. Establish recommended grass or grasses and legumes ☐ 8. Proper pasture and range management ☐ 9. Protect from burning ☐ 10. Control grazing ☐ 11. Plant recommended trees ☐ 12. Harvest trees selectively ☐ 13. Use only for wildlife or recreation area
	B. Mechanical ☐ 14. Control brush or trees ☐ 15. Terrace and farm on contour ☐ 16. Maintain terraces ☐ 17. Construction diversion terraces ☐ 18. Install drainage system ☐ 19. Control gullies ☐ 20. No mechanical treatment needed
	C. Fertilizer & Soil Amendments ☐ 21. Soil amendments ☐ 22. Phosphorus (P_2O_5) ☐ 23. Potassium (K_2O) ☐ 24. Nitrogen (N) ☐ 25. Fertilizer or soil amendments not needed

OBJECTIVE SHEET

LEGAL LAND DESCRIPTIONS

C-2

INTRODUCTION

Legal land descriptions are important for property owners and others involved in land. They are used to ensure that the land has a legal claim and that land uses are properly carried out. Understanding how to interpret legal land descriptions is a necessity for anyone involved in agricultural land use.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS

PREREADING:	Read OSU Fact Sheet F-9407, *Legal Land Descriptions in Oklahoma.*
WRITING:	Write a short (one paragraph) discussion on legal land descriptions in Oklahoma. Include why you believe understanding land descriptions is important.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. State reasons for using legal land descriptions.
2. Match line divisions used in the United States Public Land Survey (USPLS) to their descriptions.
3. Choose the correct word or phrase to complete statements about subdivisions.
4. Choose the correct word or phrase about reading USPLS system subdivision sections.
5. Identify principal meridians, base lines, and initial points.
6. Identify subdivisions of the USPLS system. (Assignment Sheet 1)
7. Interpret descriptions for the subdivision of a section. (Assignment Sheet 2)

INFORMATION SHEET — LEGAL LAND DESCRIPTIONS — C-2

OBJECTIVE 1

Optional Activities/
Resources in
Instructor's Guide

State reasons for using legal land descriptions.

WORDS YOU SHOULD KNOW	
legal land description	a written statement recognized by law as the definite location of a tract of land by reference to a survey, recorded map, adjoining property, or recorded monument
monument	permanent object, natural or artificial, that marks established points; an example of a natural monument would be a river, an example of an artificial monument would be a permanent marker, such as a stone, properly located and witnessed
plat	a map of a piece of land

- **Retrace old boundary lines** – Boundaries have to be clearly marked so that the land is used only for the intended reasons and by the legal land owner.

  ☑ **NOTE:** Many large landowners have someone walk the boundaries regularly to prevent other people from building on or using their land.

- **Locate property boundaries** – When property is leased, bought, or sold, the boundaries are checked to be sure that the claim is as it should be.

- **Lay out boundaries for specific uses** – Land to be used for timber sales, recreation sites, construction, etc., must be accurately located and marked before use.

- **Custom application** – Land to be treated with pesticides must be clearly marked for custom applicators.

OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

Match line divisions used in the United States Public Land Survey (USPLS) to their descriptions.

- **Base line** – The latitude; a principal parallel line running true east and west; intersects the principal meridians at the initial point

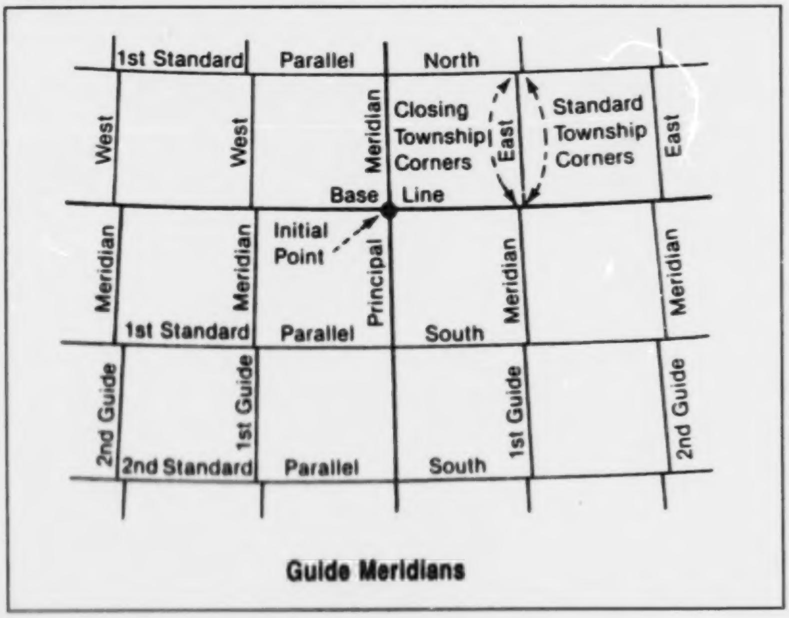
- **Principal meridian** – The longitude; a line running true north and south that intersects the base line at the initial point

- **Standard parallels** – Lines surveyed every 24 miles north and south of the base line and parallel with it

- **Guide meridians** – True meridians extended north from the base line or from standard parallels at intervals of 24 miles east and west from the principal meridian (Figure 1)

☑ **NOTE:** Standard parallels and guide meridians compensate for the curvature of the earth. Notice how the north and south parallels (also called "correction lines") are slightly curved; and the meridians are not precisely aligned.

FIGURE 1


1st Standard
Parallel
North
West
West
Meridian
Closing
Township
Corners
East
Standard
Township
Corners
East
Base
Line
Meridian
Meridian
Initial
Point
Principal
Meridian
Meridian
1st Standard
Parallel
South
2nd Guide
1st Guide
1st Guide
2nd Guide
2nd Standard
Parallel
South
Guide Meridians

- **Initial point** – formed by the intersection of the base line and the principal meridian

- **Township lines** – east-west lines at six-mile intervals parallel to the base line

  ☑ **NOTE:** Correction lines are located every six miles on the standard parallel.

- **Range lines** – north-south lines at six-mile intervals parallel to the principal meridian

OBJECTIVE 3

Required Activities/
Resources
- Transparency Master 1

Optional Activities/
Resources in
Instructor's Guide

Choose the correct word or phrase to complete statements about subdivisions.

You will see a transparency showing rectangular system subdivisions.

☑ **NOTE:** Using astronomical observation, the USPLS has established 37 initial points that serve as the starting points for subdividing public lands. The principal meridians and base lines pass through initial points and make up the framework for the system. There are 35 principal meridians and 32 base lines. The meridians are marked, monumented, and fixed by a longitudinal reading (so many degrees, minutes, and seconds west of the Greenwich Meridian). Some principal meridians are numbered, some are named, such as the Indian Meridian, The Black Hills Meridian, and the 5th Principal Meridian. The base lines are fixed astronomically (so many degrees north of the equator).

- **Quadrangles** – Approximately 24-square mile divisions bounded by the base lines, principal meridians, standard parallels, and guide meridians; divided into townships

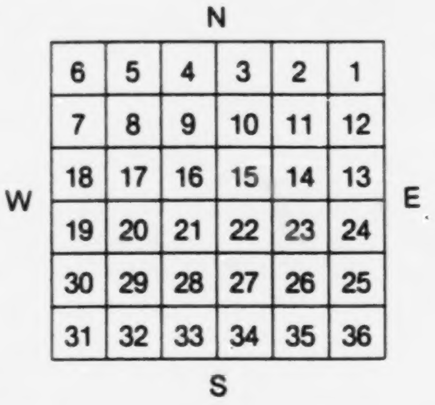
- **Townships (T)** – Division of territory six miles long on its south, east, and west boundaries and slightly less than six miles on the north; numbered consecutively North or South from an initial point to a designated border; divided into 36 sections; markers such as plates, monuments, or blazes and hacks placed at all corners

- **Ranges (R)** – Row or line of north-south townships, six miles apart and numbered consecutively east or west from an initial point to a designated area; both the township number and the range number are needed to locate a township

  EXAMPLES: T2S, R4E; T41N, R67

- **Sections** – Approximately 1 square mile (640 acres); sections in each township are numbered from 1 to 36 beginning with #1 in the northeast corner and #36 in the southeast corner; section and quarter-section corners are marked by surveyors (Figure 2)

FIGURE 2

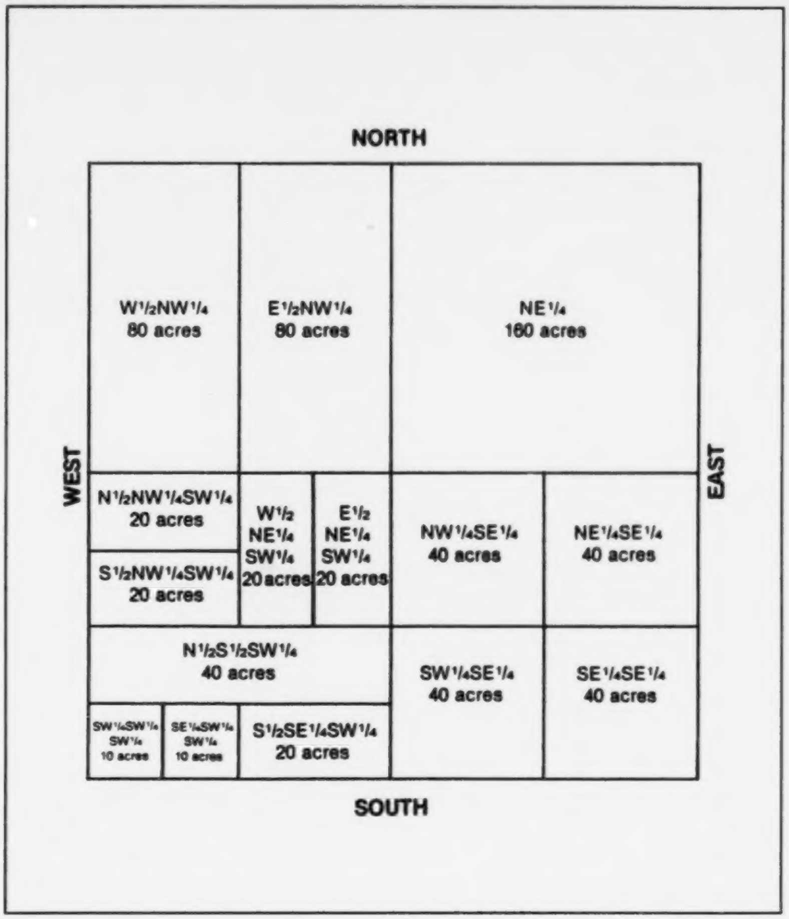


6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Numbered Section

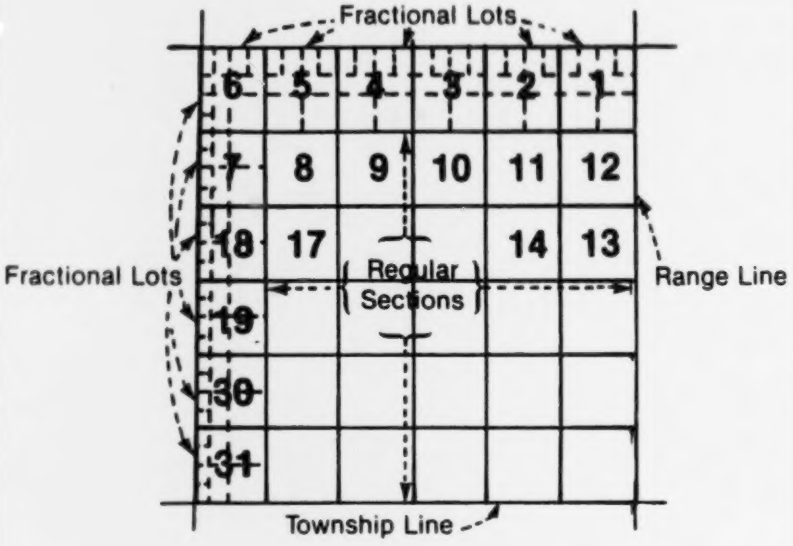
- **Section subdivisions** – Tracts of 320, 160, 80, 40, 20, and 10 acres with descriptions in halves and quarters (Figure 3)

FIGURE 3


NORTH
WEST
EAST
SOUTH
W½NW¼ 80 acres
E½NW¼ 80 acres
NE¼ 160 acres
N½NW¼SW¼ 20 acres
S½NW¼SW¼ 20 acres
W½ NE¼ SW¼ 20 acres
E½ NE¼ SW¼ 20 acres
NW¼SE¼ 40 acres
NE¼SE¼ 40 acres
N½S½SW¼ 40 acres
SW¼SE¼ 40 acres
SE¼SE¼ 40 acres
SW¼SW¼ SW¼ 10 acres
SE¼SW¼ SW¼ 10 acres
S½SE¼SW¼ 20 acres

- **Correction lots or fractional sections** – Partial 40 acre lots located on the north and west borders of a township to compensate for the lack of perfect squares due to the convergence of meridians and other causes; expected in counties bordering oceans, lakes and streams (Figure 4)

FIGURE 4

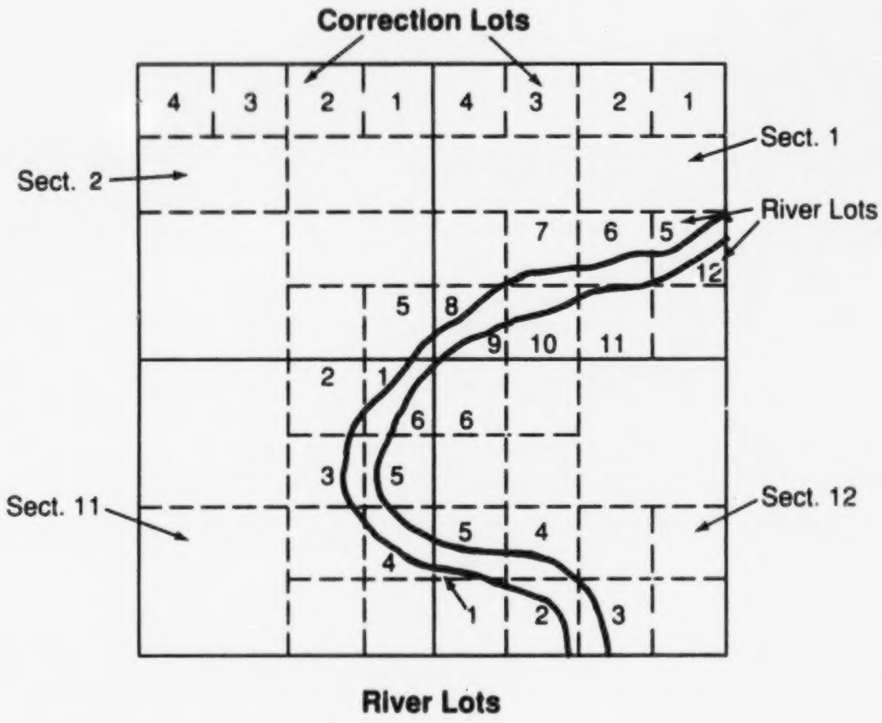

Fractional Lots
6
5
4
3
2
1
7
8
9
10
11
12
Fractional Lots
18
17
Regular Sections
14
13
Range Line
19
30
31
Township Line

Fractional Lots

723

- **River lots** – Lot numbers usually run downstream to a section line and then back upstream to the line. (Figure 5)

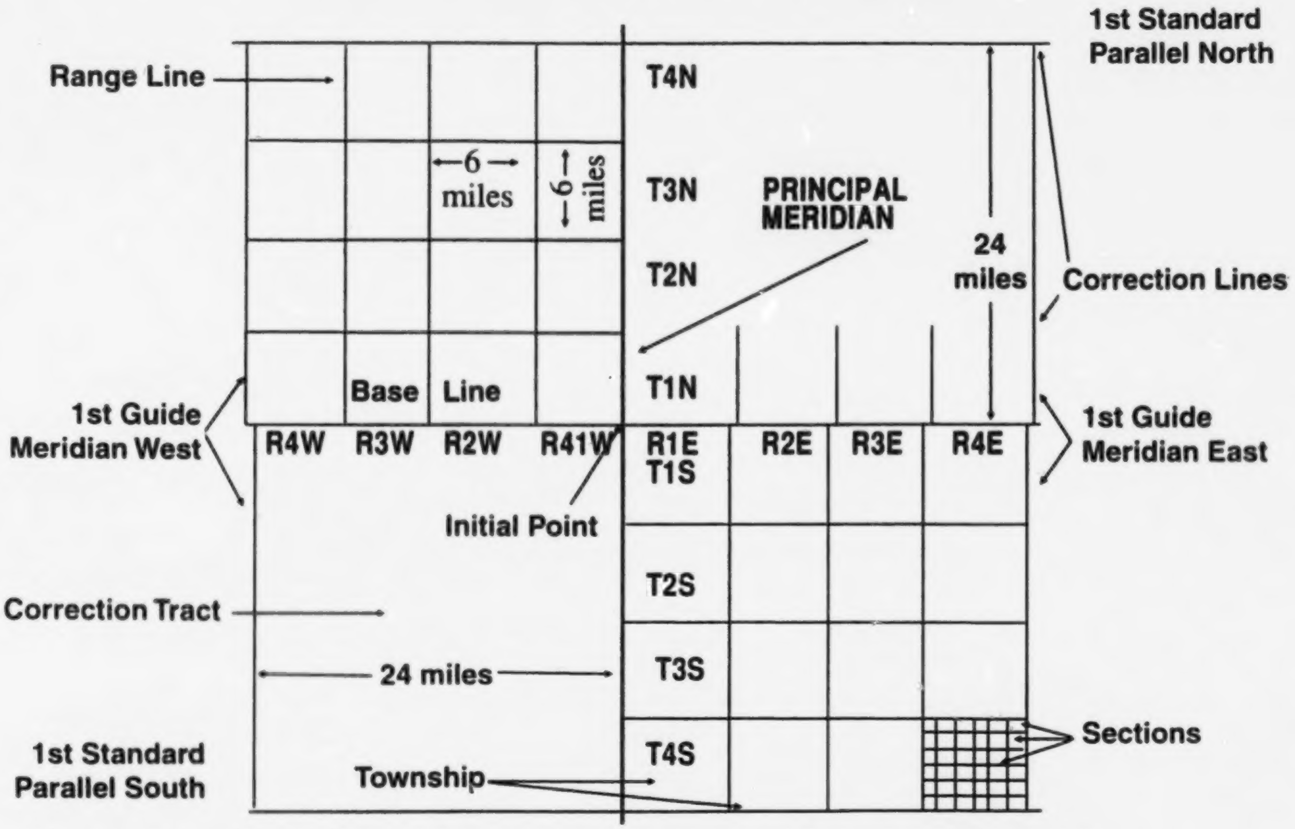
FIGURE 5


Correction Lots
4
3
2
1
4
3
2
1
Sect. 1
Sect. 2
River Lots
7
6
5
12
5
8
9
10
11
2
1
6
6
3
5
Sect. 11
Sect. 12
5
4
4
1
2
3
River Lots

☑ **NOTE:** Figure 6 illustrates rectangular system subdivisions.

FIGURE 6

RECTANGULAR SYSTEM SUBDIVISIONS


1st Standard Parallel North
Range Line
T4N
←6→ miles
↑6↓ miles
T3N
PRINCIPAL MERIDIAN
24 miles
T2N
Correction Lines
Base
Line
T1N
1st Guide Meridian West
1st Guide Meridian East
R4W
R3W
R2W
R41W
R1E
T1S
R2E
R3E
R4E
Initial Point
T2S
Correction Tract
24 miles
T3S
Sections
T4S
1st Standard Parallel South
Township

The location of the initial point, base line, principal meridian, standard parallels, guide meridians, ranges, townships, and sections.

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Choose the correct word or phrase about reading USPLS system subdivision sections.

- A full legal description goes from small divisions to increasingly larger divisions:
  - Lot
  - Quarter-quarter section (sixteenth section)
  - Quarter section
  - Half section
  - Section
  - Township and range
  - Principal meridian

  EXAMPLE: All that part of the Northeast Quarter of the Northeast Quarter of Section 12, Township 5 North, Range 2 East of the Fifth Principal Meridian, Clarion Township, Walker county, and State of Missouri

  NE1/4 NE1/4 Section 12, T5N, R2E, 5th Principal Meridian

- It is easier to read and write legal descriptions from right to left (backwards).

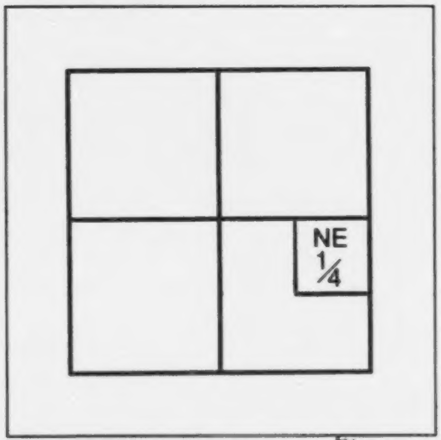
  EXAMPLE: NW1/4 SW1/4, W1/2 Section 6, T55N, R69W

  Read as: Range 69 West, Township 55 North, Section 6, West half, Southwest quarter, Northwest quarter (of the southwest quarter)

- Two letters alone means 1/4. (Figure 7)

  EXAMPLE: NE1/4 SE1/4 means the northeast quarter of the southeast quarter.

FIGURE 7

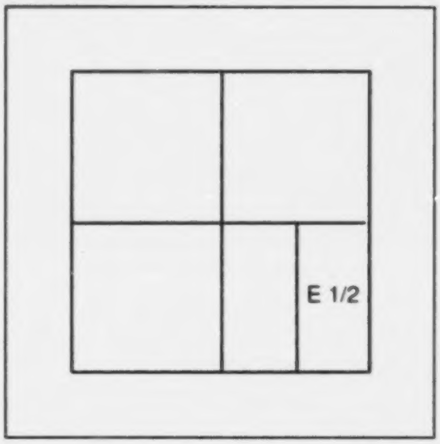


727

- A single letter means 1/2. (Figure 8)

  EXAMPLE: E1/2 SE 1/4 is combination of SE quarter of E half.

  FIGURE 8



- Acreage can be determinied by the section subdivision.

  EXAMPLES:

  Section = 640 acres

  1/2 section = 320 acres

  1/4 section = 160 acres

  1/2 of 1/4 = 80 acres

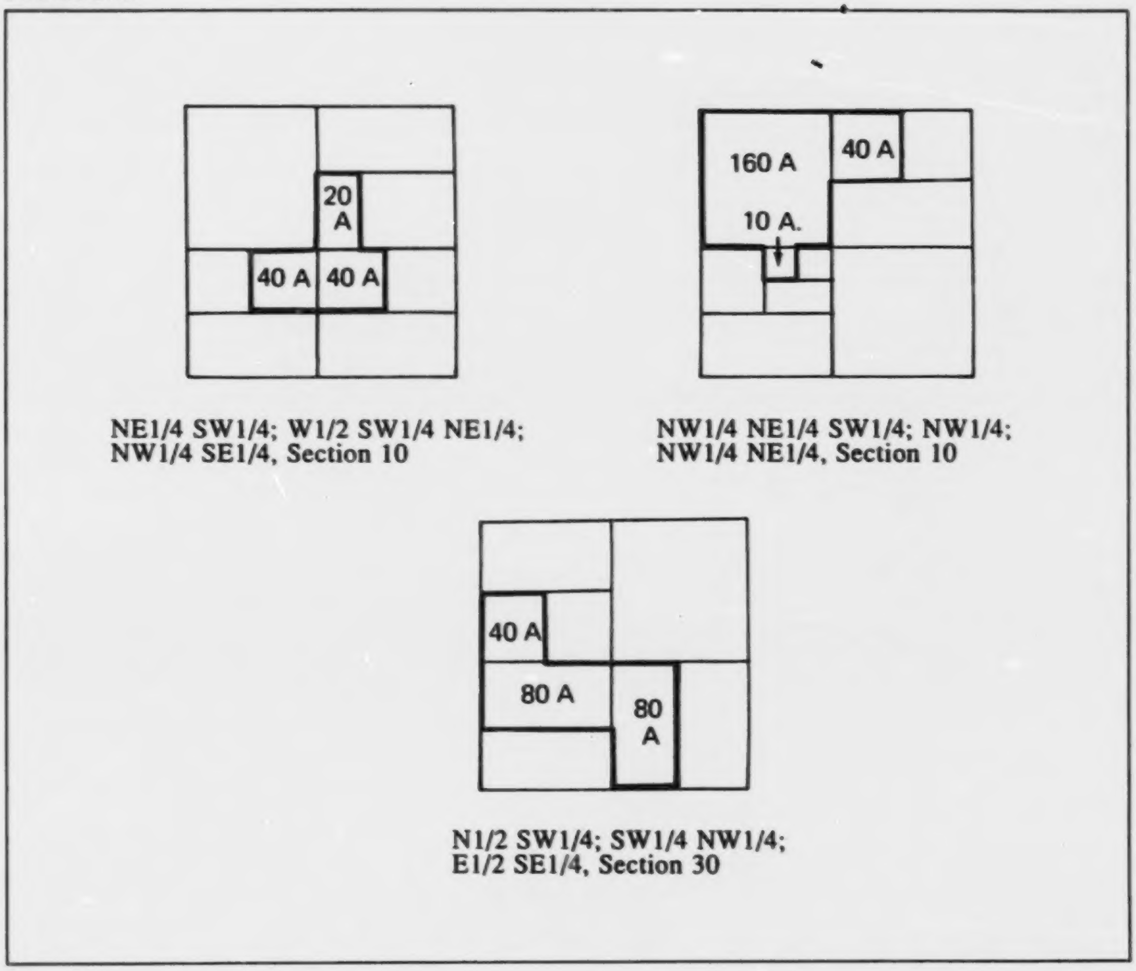
  1/4 of 1/4 = 40 acres

- Single-tract subdivisions are written as continuous descriptions; separate tracts are divided by one of the following:

  and, &, and **; (semicolon)** (Figure 9)

  EXAMPLES:

FIGURE 9



NE1/4 SW1/4; W1/2 SW1/4 NE1/4; NW1/4 SE1/4, Section 10

NW1/4 NE1/4 SW1/4; NW1/4; NW1/4 NE1/4, Section 10

N1/2 SW1/4; SW1/4 NW1/4; E1/2 SE1/4, Section 30

OBJECTIVE 5

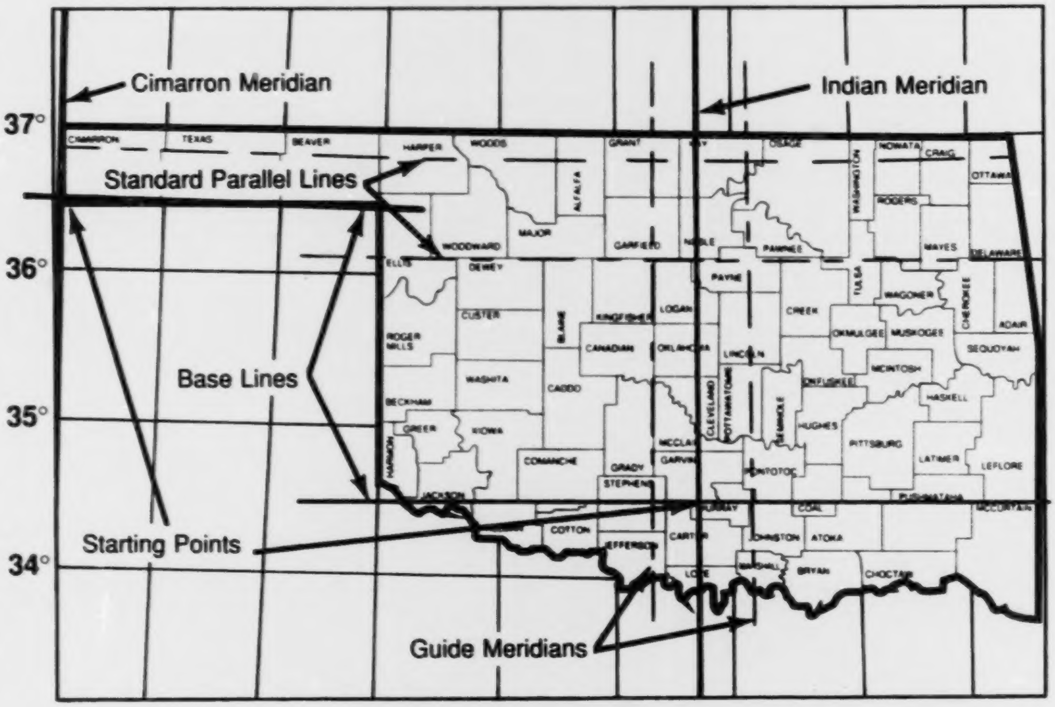
Required Activities/
Resources
- Transparency Master 2

Optional Activities/
Resources in
Instructor's Guide

Identify principal meridians, base lines, and initial points.

You will see a transparency showing the principal meridians, base lines, and initial points.

FIGURE 10


Cimarron Meridian
Indian Meridian
37°
Standard Parallel Lines
36°
Base Lines
35°
Starting Points
34°
Guide Meridians
CIMARRON
TEXAS
BEAVER
HARPER
WOODS
GRANT
KAY
OSAGE
NOWATA
CRAIG
OTTAWA
ALFALFA
MAJOR
WOODWARD
GARFIELD
NOBLE
PAWNEE
WASHINGTON
ROGERS
MAYES
DELAWARE
ELLIS
DEWEY
PAYNE
TULSA
WAGONER
CHEROKEE
ADAIR
CUSTER
BLAINE
KINGFISHER
LOGAN
CREEK
OKMULGEE
MUSKOGEE
SEQUOYAH
ROGER MILLS
CANADIAN
OKLAHOMA
LINCOLN
MCINTOSH
WASHITA
CADDO
CLEVELAND
POTTAWATOMIE
SEMINOLE
OKFUSKEE
HASKELL
BECKHAM
GREER
KIOWA
MCCLAIN
HUGHES
PITTSBURG
LATIMER
LEFLORE
HARMON
COMANCHE
GRADY
GARVIN
PONTOTOC
JACKSON
STEPHENS
MURRAY
COAL
PUSHMATAHA
MCCURTAIN
TILLMAN
COTTON
JEFFERSON
CARTER
JOHNSTON
ATOKA
LOVE
MARSHALL
BRYAN
CHOCTAW

Location of the two principal meridians (—) and base lines (—) in Oklahoma. Two guide meridians (— - —) and two standard parallel lines (---) are also shown.

OBJECTIVE 6 **Complete Assignment Sheet 1.**

OBJECTIVE 7 **Complete Assignment Sheet 2.**

ASSIGNMENT SHEET 1

LEGAL LAND DESCRIPTIONS

C-2

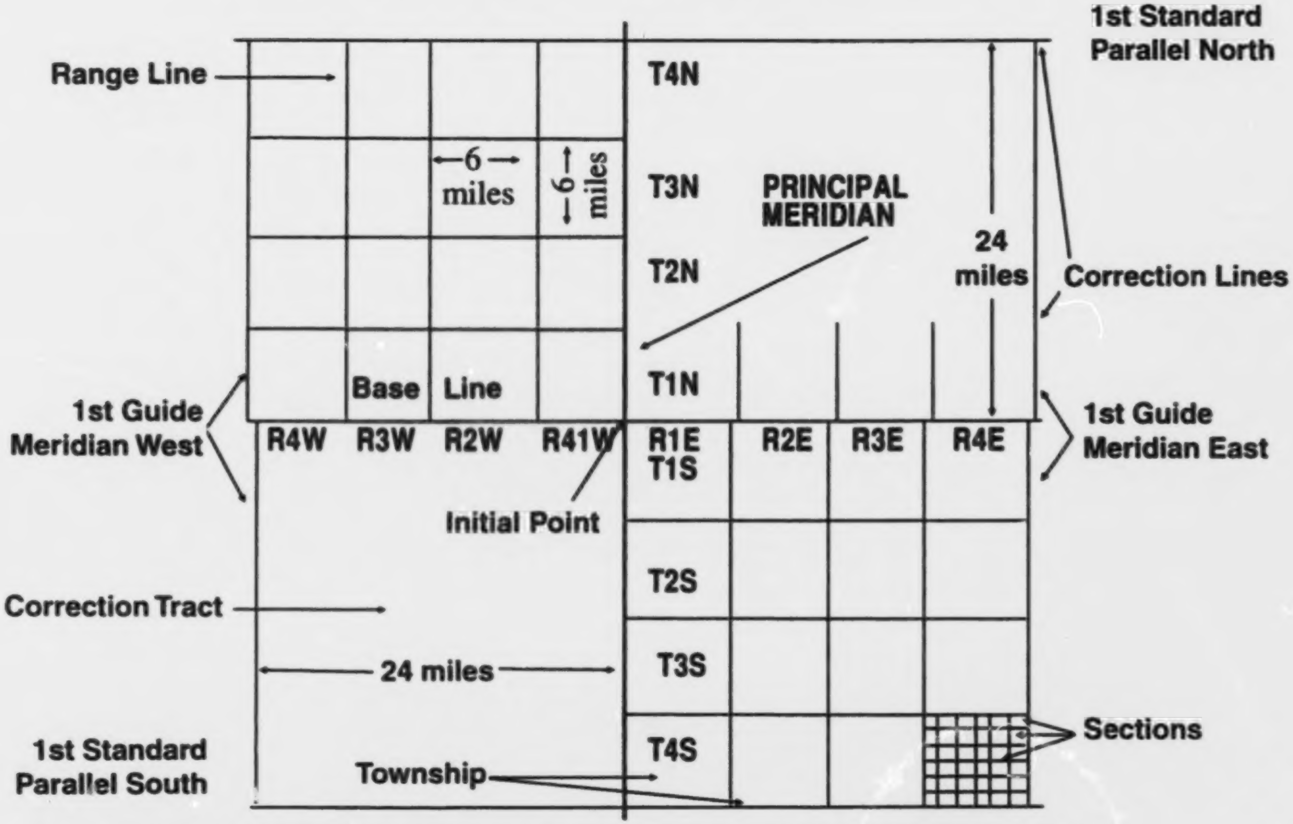
Name ______________________________ Score __________

OBJECTIVE 6 **Identify subdivisions of the USPLS system.**

INSTRUCTIONS Refer to the rectangular system subdivision figure on the following page and then answer the questions that follow.

Functional Reading
- Interpret graphics and symbols

RECTANGULAR SYSTEM SUBDIVISIONS


1st Standard Parallel North
Range Line
T4N
←6→ miles
↑6↓ miles
T3N
PRINCIPAL MERIDIAN
24 miles
T2N
Correction Lines
T1N
Base
Line
1st Guide Meridian West
1st Guide Meridian East
R4W
R3W
R2W
R41W
R1E
T1S
R2E
R3E
R4E
Initial Point
Correction Tract
T2S
24 miles
T3S
Sections
1st Standard Parallel South
T4S
Township

The location of the initial point, base line, principal meridian, standard parallels, guide meridians, ranges, townships, and sections.

1. Write the legal description of the townships below. The first one is done for you as an example.

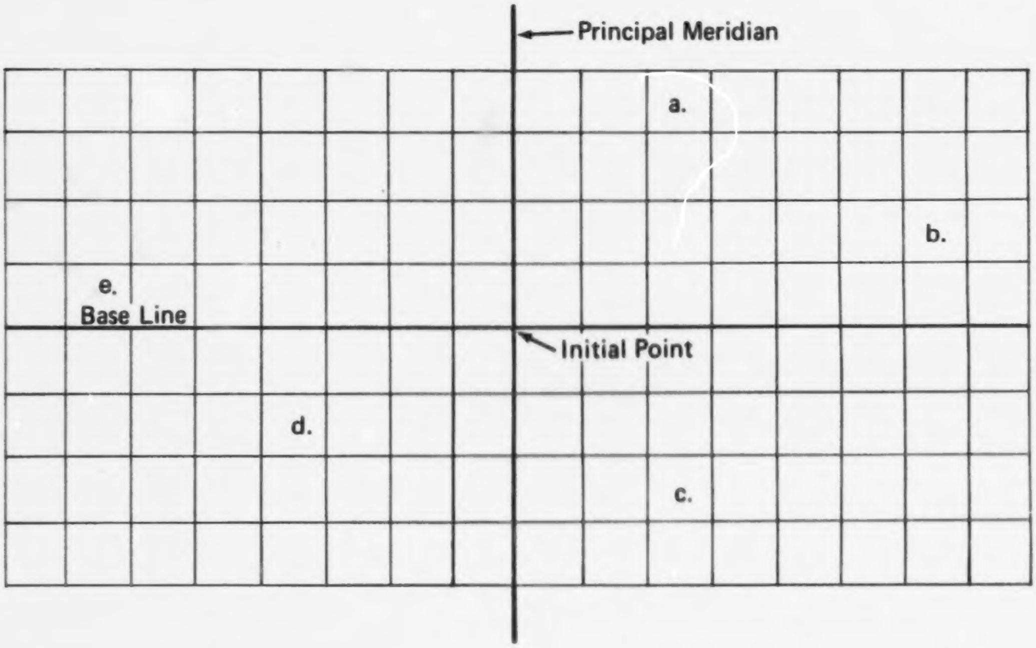
   a. T4N, R3E

   b. ____________________

   c. ____________________

   d. ____________________

   e. ____________________


Principal Meridian
a.
b.
e.
Base Line
Initial Point
d.
c.

2. Write the correct section numbers in the township below.

3. Write the correct section numbers for the sections marked below.

a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________

			a		
	b				
c					
d					e

ASSIGNMENT SHEET 2

LEGAL LAND DESCRIPTIONS

C-2

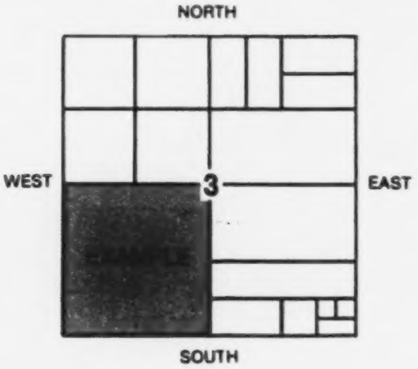
Name ______________________________ Score __________

OBJECTIVE 7 **Interpret descriptions for the subdivision of a section.**

INSTRUCTIONS Refer to objective 3 to complete Part 1 and Part 2.

PART 1 – Write descriptions for the subdivision of a section and determine the acreage as shown in the example:

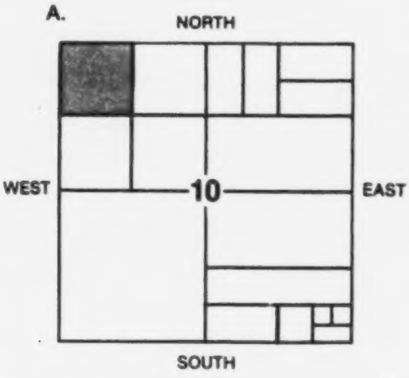
Functional Reading
- Interpret graphics and symbols


NORTH
WEST
3
EAST
EXAMPLE
SOUTH

SW ¼, SECTION 3

ACRES: 160

A.

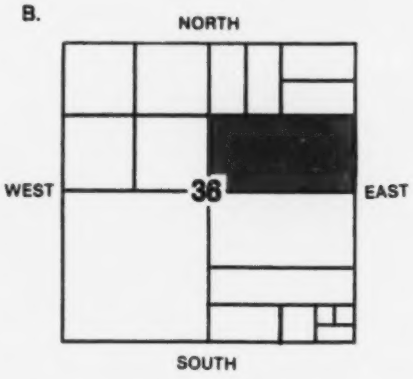

NORTH
WEST
10
EAST
SOUTH

____

____

ACRES:__________________

B.

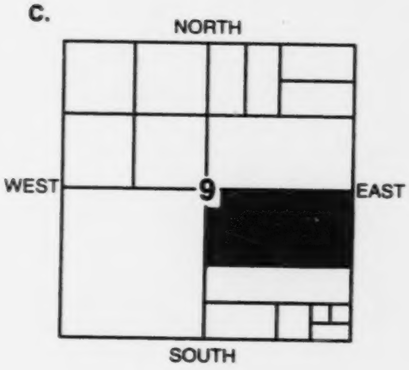

NORTH
WEST
36
EAST
SOUTH

____

____

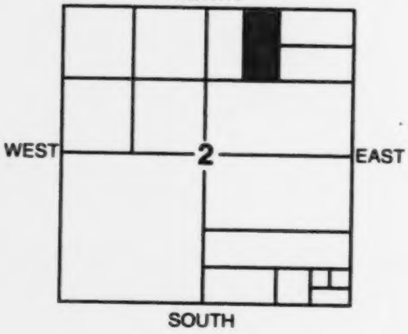
ACRES:__________________

C.


NORTH
WEST
9
EAST
SOUTH

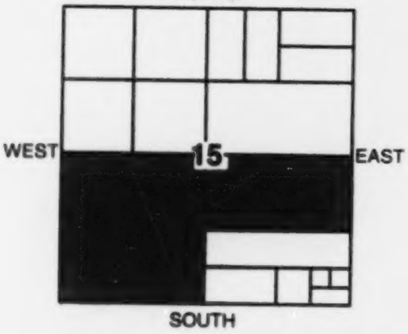
ACRES:

D.


NORTH
WEST
2
EAST
SOUTH

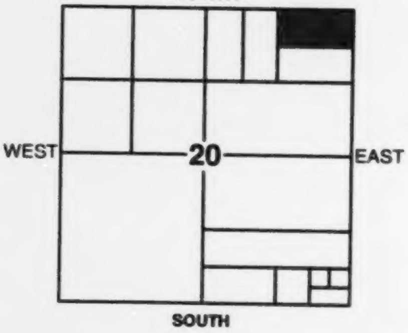
ACRES:

E.


NORTH
WEST
15
EAST
SOUTH

ACRES:

F.

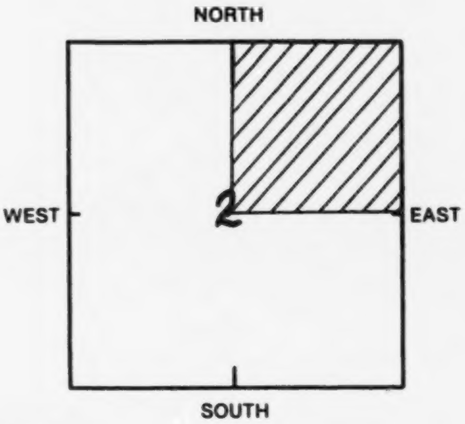

NORTH
WEST
20
EAST
SOUTH

ACRES:

PART 2 – Locate subdivisions if a section.

The illustrations represent sections and legal descriptions. For each:

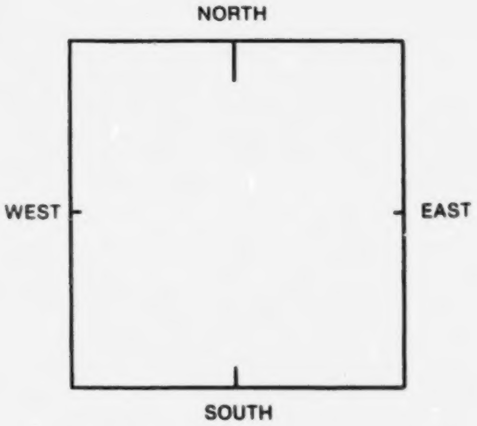
1. Label the section number in the center of the section.
2. Subdivide each section according to the legal description. Shade the area.
3. Give the acreage of the shaded area in the space provided.



ACRES: 160

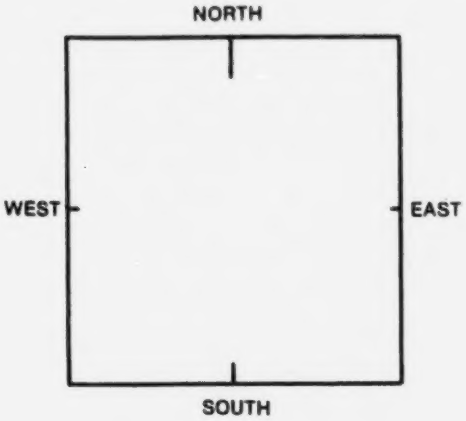
Example: NE1/4, Section 2

A. SE1/4 SE1/4, Section 10


NORTH
WEST
EAST
SOUTH

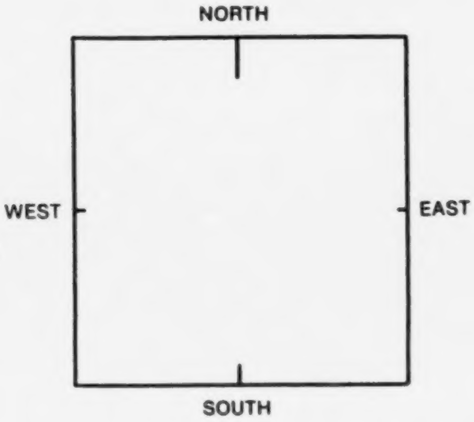
ACRES:____________________

B. N1/2, NE1/4, Section 31


NORTH
WEST
EAST
SOUTH

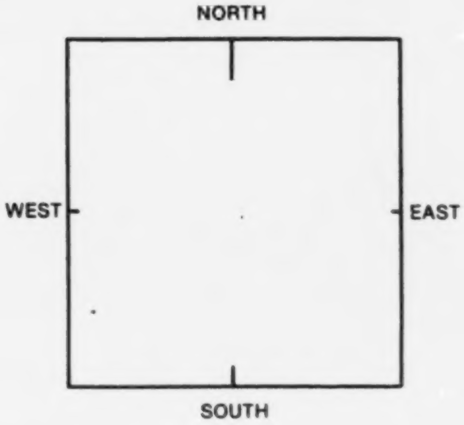
ACRES:____________________

C. SW1/4, NW1/4, SW1/4, Section 7


NORTH
WEST
EAST
SOUTH

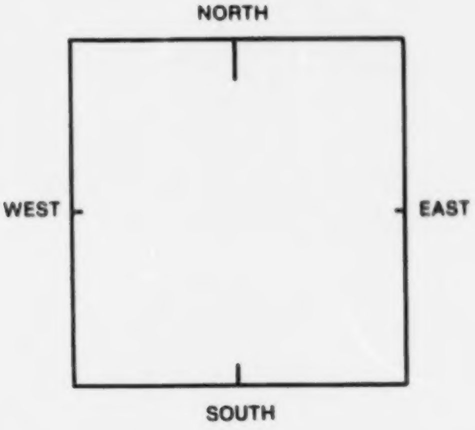
ACRES:____________________

D. SE1/4 & S1/2 NE1/4, Section 23


NORTH
WEST
EAST
SOUTH

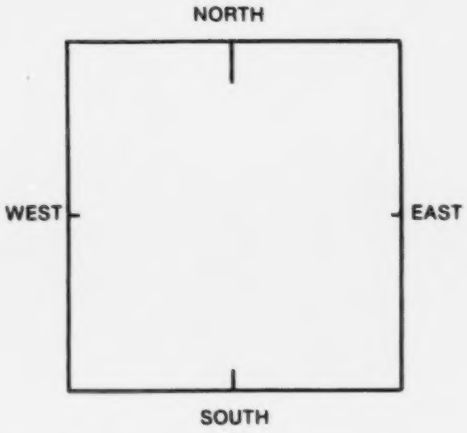
ACRES:____________________

E. N1/2, Section 5


NORTH
WEST
EAST
SOUTH

ACRES:____________________

F. SE1/4, NE1/4, SW1/4, Section 16


NORTH
WEST
EAST
SOUTH

ACRES:____________________

Soil, Plant, and Crop Science

Student Workbook

Part 2

Developed by the
Curriculum and Instructional Materials Center
for the Division of Agricultural Education
Oklahoma Department of Vocational and Technical Education

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Curriculum and Instructional Materials Center

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742

TABLE OF CONTENTS

Student Workbook

One set per unit of Objective Sheets, Information Sheets, Assignment Sheets, and Job Sheets for the following units:

SECTION A

Unit 1 Introduction to Soil, Plant, and Crop Science A1-1
Unit 2 Safety A2-1
Unit 3 Careers A3-1

SECTION B

Unit 1 Soils B1-1
Unit 2 Soil Sampling B2-1
Unit 3 Fertilizers and Irrigation B3-1
Unit 4 Soil Conservation Practices B4-1

SECTION C

Unit 1 Land Uses and Classification C1-1
Unit 2 Land Legal Descriptions C2-1

SECTION D

Unit 1 Growth and Reproduction D1-1
Unit 2 Seeds and Plants: Selection, Preparation, and Planting D2-1
Unit 3 Common Pests D3-1
Unit 4 Controlling Pests D4-1
Unit 5 Native and Improved Pastures D5-1
Unit 6 Harvesting D6-1

SECTION E

Unit 1 Marketing Crops and Grades E1-1
Unit 2 Price Trends and Cycles E2-1

OBJECTIVE SHEET

GROWTH AND REPRODUCTION

D-1

INTRODUCTION

Certain laws of nature are at work with every plant that grows and reproduces. Science builds on these laws to continually create new ways to improve and protect crops. Successful farmers understand the basics and stay abreast of new developments that can help improve their yield... and their profits!

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS	
PREREADING:	Read *Hybrid Sorghum Performance Trials in Oklahoma, 1990*, OSU Extension Circular No. 866.
WRITING:	Write a short essay (one paragraph to one page) on the results of one performance trial.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Arrange in order the stages in the life cycle of plants.
2. Explain transpiration.
3. State the formula for respiration.
4. Explain the process of respiration.
5. State the formula for photosynthesis.
6. Discuss types of plants based upon their agronomic classification.
7. Label parts of a legume, grain, and tuber.
8. Describe methods of crop improvement.
9. Define genetic engineering.
10. Define cloning.
11. Describe uses of defoliants and growth inhibitors.
12. Calculate the percent of germination to determine the rate of application. (Assignment Sheet 1)
13. Present an oral report on a recent development in plant or crop technology. (Assignment Sheet 2)

INFORMATION SHEET

GROWTH AND REPRODUCTION

D-1

OBJECTIVE 1

Required Activities/
Resources
- Transparency Master 1

Optional Activities/
Resources in
Instructor's Guide

Arrange in order the stages in the life cycle of plants.

You will see one transparency showing the life cycle of plants.

WORDS YOU SHOULD KNOW	
active growth	the stage where a growing plant no longer depends upon its reserve of food stored in the seed; its roots remove nutrients from the soil, and the leaves, through photosynthesis, manufacture its food as it grows
germination	the sprouting of a seed, and the beginning of plant growth
maturation	becoming mature or ripe
reproduction	the production of offspring by organized bodies; in plants that create offspring sexually (all of which create flowers) it is the point where pollen from the male part of the flower fertilizes the ovaries of the female part, the result of which is a seed
seedling	the early growth stage of a plant grown from seed as it emerges above the ground surface
viable	capable of germinating

Before the life cycle of plants can begin, a viable seed must be planted. If the viable seed is then exposed to the necessary amount of water, oxygen-containing air and the proper temperature, the life cycle of that seed/plant progresses as follows:

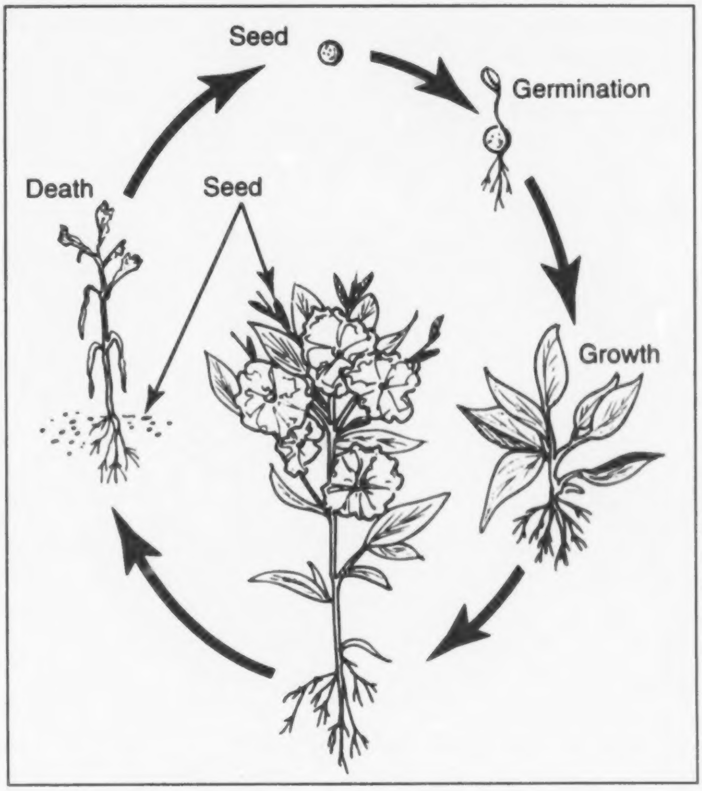
- Germination
- Seedling

- Active growth
- Reproduction
- Maturation

Each stage of the life cycle of plants depends on all the other stages. Plants create seeds through their reproductive process that mature to the point where they can be planted and go through germination. And without germination, and development as a seedling and its period of active growth, the plant could not develop to the point of reproducing.

An illustration of the life cycle of plants follows:

FIGURE 1



OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

Explain transpiration.

WORDS YOU SHOULD KNOW	
evaporation	the changing of liquid into a gas; loosely the equivalent of dehydration
guard cell	one of two epidermal cells in a plant leaf or needle that encloses a stoma
stoma	an opening in the epidermal layer of plant tissues which leads to an internal air cavity; also known as a breathing pore
transpiration	process by which a living plant releases water vapor into the atmosphere

- About 90% of the water that enters plants is lost through transpiration. This loss takes place primarily through the leaf stoma.
- Humidity, wind and other air movement, and temperature all influence transpiration.
    - ☐ The rate of transpiration decreases as humidity increases; as humidity decreases the rate of transpiration increases.
    - ☐ Due to the evaporation it causes, increased air movement raises the rate of transpiration.
    - ☐ When temperatures go up, the rate of transpiration also increases.
- When a plant is not watered transpiration can cause it to lose water faster than it can be replaced by the root system.

☑ **NOTE:** When this occurs, the guard cells close the stoma in the plants, which slows the rate of transpiration. This helps the plant retain the water it contains. Although the plant may wilt slightly if there is water in the soil, it will recover. However, the plant may not be able to recover if the soil is very dry.

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

State the formula for respiration.

WORDS YOU SHOULD KNOW	
respiration	process by which living cells (plant or animal) take in oxygen and give off water and carbon dioxide

The formula for respiration is

$C_6H_{12}O_6 + 6O_2$ ---> + $6H_2O + 6CO_2$ ^
(sugar) (oxygen) (water) (carbon dioxide)

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Explain the formula for respiration.

WORDS YOU SHOULD KNOW	
photosynthesis	a series of processes in which light energy is converted to chemical energy in the form of a simple sugar

In essence, respiration is the reversal of the photosynthesis reaction. When oxygen from the air combines with the sugar produced by the plant during photosynthesis, the oxygen "burns" the sugar and converts it into carbon dioxide (which is released into the atmosphere as gas) and water.

OBJECTIVE 5

Required Activities/
Resources
- Transparency Master 2

Optional Activities/
Resources in
Instructor's Guide

State the formula for photosynthesis.

WORDS YOU SHOULD KNOW	
carbon dioxide	a colorless and odorless gas formed by the burning of carbon exhaled by animals in the respiration process
glucose	a simple sugar

For photosynthesis to occur, light (usually from the sun) must strike a plant. This causes the plant to convert carbon dioxide in the air and water in the soil into glucose and oxygen. The oxygen is then released into the air.

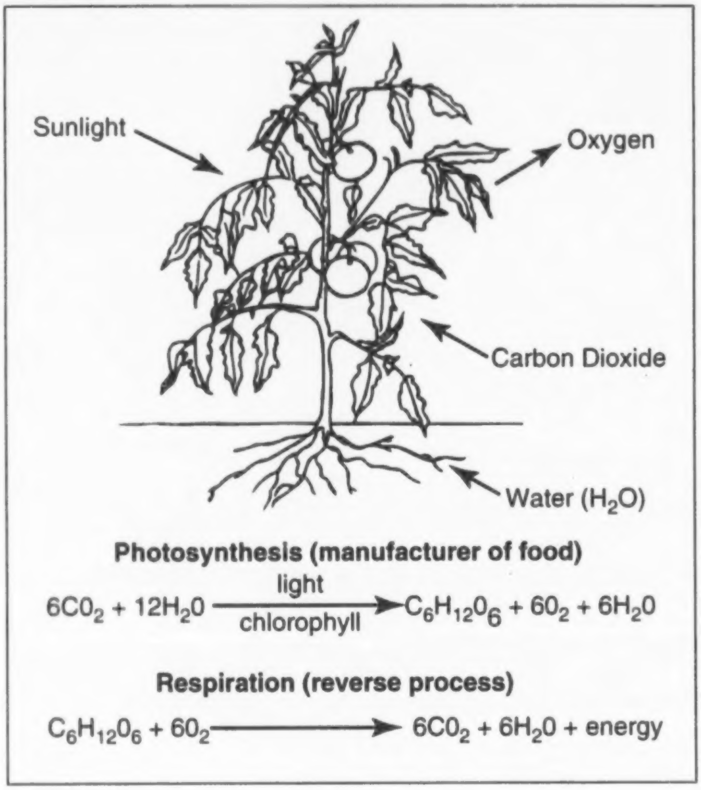
Chemists diagram the process of photosynthesis as follows:

$6CO_2$ + $6H_{12}O$ ---> $C_6H_{12}O_6$ + $6O_2$ ^
(carbon (water) (sugar) (oxygen)
dioxide)

☑ **NOTE:** The arrow beside the "$6O_2$" in this formula means the oxygen is released as a gas and passes into the atmosphere. This is the oxygen that animals breathe in normal respiration. Photosynthesis will only occur in the presence of sunlight.

A diagram of how photosynthesis works is shown below.

FIGURE 2



Photosynthesis (manufacturer of food)

$$6C0_2 + 12H_20 \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}0_6 + 60_2 + 6H_20$$

Respiration (reverse process)

$$C_6H_{12}0_6 + 60_2 \longrightarrow 6C0_2 + 6H_20 + \text{energy}$$

OBJECTIVE 6

Optional Activities/
Resources in
Instructor's Guide

Discuss types of plants based on their agronomic classification.

WORDS YOU SHOULD KNOW	
agronomic classification	classifying plants according to the use of the crop
tuber	thickened or swollen underground branch or horizontal stem with numerous buds (eyes) on the surface

Plants grown for farming purposes are divided into the following agronomic classifications:

- Cereals or Grain Crops
    - ☐ "Cereal crops," also known as "small grain," refer to any member of the grass family grown for its edible fruit or seed; includes wheat, barley, rye, oats, and rice.
    - ☐ "Grain" refers to all crops grown for their seed or grain to be used for food or feed.
- Oil-Seed Crops
    - ☐ Grown for the vegetable oil and concentrated protein contained in the seed
    - ☐ Includes soybeans (chief among these crops), peanuts, sunflowers, safflowers, rapeseed (canola), and carambe
    - ☐ Includes corn when it is grown for the oil that can be extracted
- Forage and Pasture Crops
    - ☐ Grown primarily for their leaf or plant parts to be used for livestock feed
    - ☐ Contains a number of crops also included in other classifications

      EXAMPLE: Although corn is included in the grain and oil-seed crop categories, it is also considered a forage crop when it is cut, chopped, and placed in a silo.

  - ☐ Primary forage crops include: alfalfa, clovers, lespedeza, birdsfoot trefoil, Kentucky bluegrass, smooth brome grass, orchard grass, tall fescue, and Bermuda grass
  - ☐ Also includes sorghums, corn, millets, Sudan grass, and various small grains used for hay and pasture
- Root and Tuber Crops
  - ☐ Grown for their underground storage organs, which are either roots or tubers
  - ☐ Used primarily for animal or human consumption

    EXAMPLES: Potatoes, sugar beets, turnips, mangels, carrots, rutabagas, and sweet potatoes
- Sugar Crops
  - ☐ Any crop grown for sugar production
  - ☐ Includes sugar beets, sweet sorghums, sugarcane, and corn when it is grown for fructose
- Fiber Crops
  - ☐ Provide materials for clothing and shelter
  - ☐ Principal U.S. fiber crop is cotton; flax and kenaf are also grown
- Special Crops
  - ☐ Grown as something other than a source of fiber or food for humans or animals
  - ☐ Tobacco and hops are the most widely grown of these crops.

OBJECTIVE 7

Required Activities/
Resources
- Transparency Masters 3-5

Optional Activities/
Resources in
Instructor's Guide

Label parts of a legume, grain, and tuber.

You will see three transparencies showing the parts of a legume, grain, and tuber.

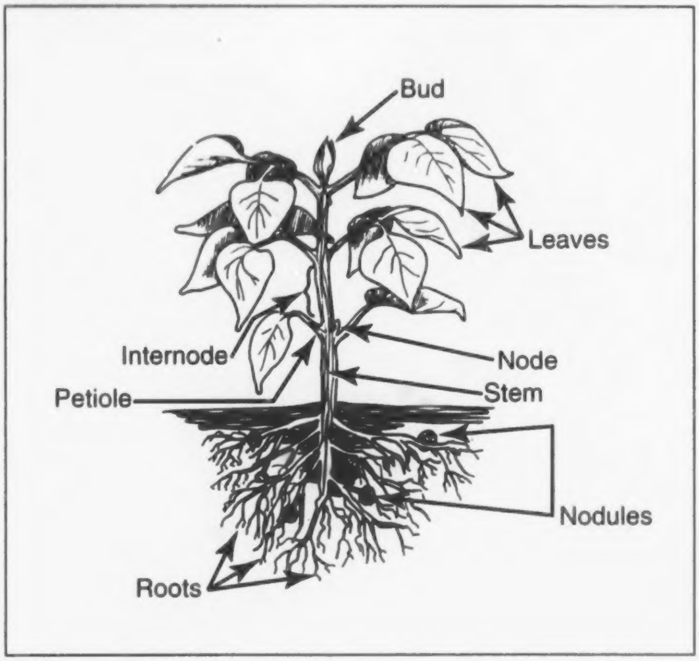
WORDS YOU SHOULD KNOW	
aleurone layer	in wheat and corn, the outer differentiated layer of cells of the endosperm
cambium layer	actively growing cells that give rise to the secondary xylem and phloem
cotyledon	seed leaf; part of the new plant and filled with food (mainly oil and protein) to be used during germination
endosperm	the nutritive portion in some seeds that originates in the embryo sac, but which is outside the embryo; serves as food for the growing plant during germination
epidermis	outer skin; cellular layer of an organism
hilum	in the seed the scar or mark showing the point of attachment to the plant
hull	outer shell or covering
hypocotyl	connects the root and cotyledons and the radicle
legume	a family of broad-leafed, nitrogen-bearing plants that includes peas, beans, soybeans, peanuts, clovers, alfalfas, sweetclovers, lespedezas, vetches, and kudzu
mesocarp	layer between endocarp and epicarp of a multi-layered pericarp
micropyle	minute necklike opening in the covering layer of an ovule, where the sperms enter
nodules	a small lump or tuber that forms on certain legumes as a result of an invasion by nitrogen-fixing bacteria

WORDS YOU SHOULD KNOW

pericarp	the outer layer of the ovary wall around the seeds; it sometimes consists of three separate structural layers: the endocarp, the mesocarp, and the epicarp
phloem	principle tissue concerned with moving food produced in leaves or other areas down into branches, stem, and roots
pith	spongy center; serves as storehouse for moisture and food
plumule	tip of the stem, often has reasonably well-developed leaves
radicle	embryonic roots of seed plants
scutellum	cotyledon of the grasses; sometimes referred to as the seed leaf
seed coat (testa)	hard outer layer/protective covering of a seed
tubers	thickened or swollen underground branch or stolon with numerous buds (eyes); thickening occurs because of the accumulation of reserved food; includes Irish potato and Jerusalem artichoke
xylem	"plumbing" system that moves water and dissolved minerals up the stems from the roots

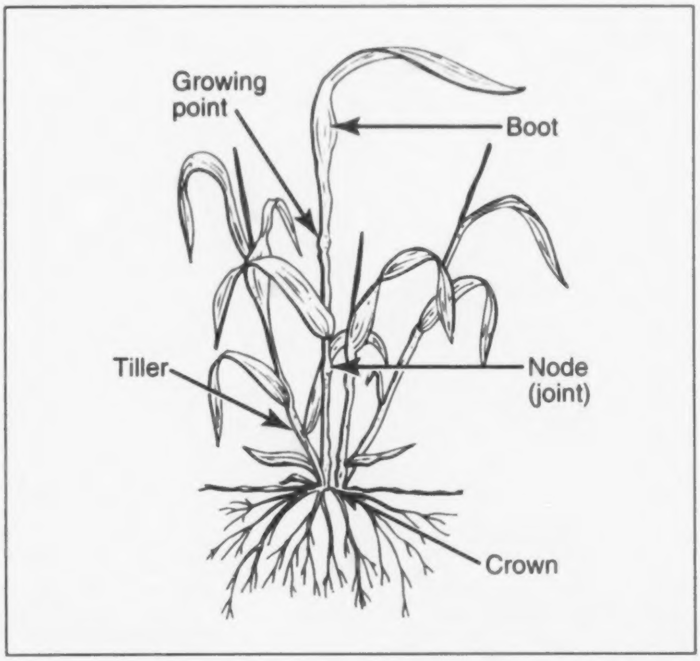
Parts of a legume (Figure 3):

FIGURE 3


Bud
Leaves
Internode
Node
Petiole
Stem
Nodules
Roots

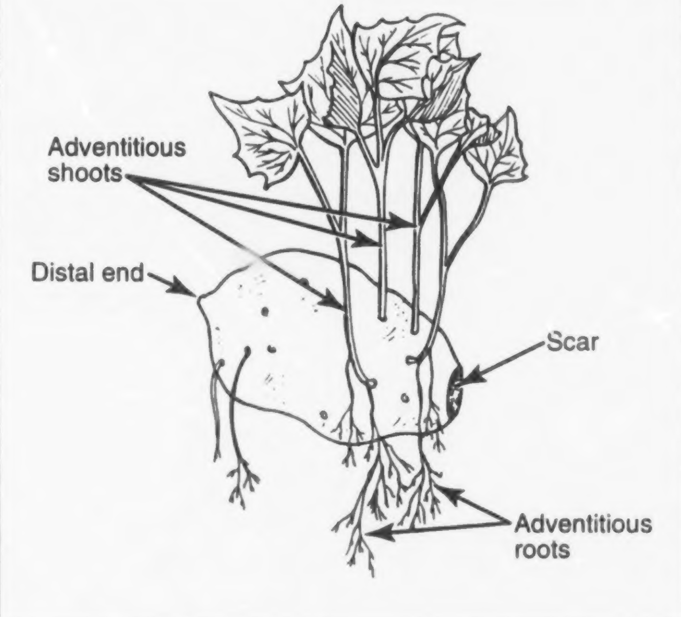
Parts of a grain (Figure 4):

FIGURE 4


Growing point
Boot
Tiller
Node (joint)
Crown

Parts of a tuber (Figure 5):

FIGURE 5


Adventitious shoots
Distal end
Scar
Adventitious roots

756

OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

Describe methods of crop improvement.

WORDS YOU SHOULD KNOW	
hybrid	something resulting from a cross between two different species or varieties
hybridization	the production of hybrids by natural crossing or by manipulated crossing
mutant, mutation	a variant, differing genetically and often visibly from its parent or parents and arising rather suddenly or abruptly
selection	choosing certain individuals (in this case plants) for reproducing offspring in order to continue or improve some desired quality or characteristic in the offspring

The three general methods for improving self-fertilized crops include:

- Introducing varieties developed elsewhere
  - ☐ Offers the advantage of using crops that have already been developed and tested somewhere else

    ☑ **NOTE:** Often, new varieties are developed by the workers in state agricultural experiment stations and seed companies. As a result, they are carefully tested before being recommended to the growers of a state or region. Rapid introduction is made possible through close cooperation between the various state agricultural experiment stations and the United States Department of Agriculture.

  - ☐ Normally presents few problems in terms of adaptation, so long as the variety was originally developed in a state with similar soil and climatic conditions

- Selection
  - ☐ Limited in scope, for nothing new has been created; can only be made from existing material

    ☑ **NOTE:** If a superior type isn't available, then a superior selection can not be made.

  - ☐ Involves two general methods: mass selection and individual plant selection
    - ▸ Mass selection is largely a case of selecting individual plants or heads from an existing crop variety.
    - ▸ Individual plant selections are made from the plants that were grown from the seed of the plants chosen as a result of mass selection. The individual selections are made after the new plants are tested for agronomically desirable characteristics.
  - ☐ Mutants often appear in large populations of plants of a particular species; sometimes with desirable characteristics
    - ▸ Since mutated characteristics are likely to be repeated in future generations, it is possible to select from mutants for breeding purposes.
    - ▸ Many plant breeders intentionally cause mutation by treating seed with radiation.
- Hybridization
  - ☐ Allows breeders to develop something new, instead of just using what already exists
  - ☐ Is often used to cross varieties, so as to combine disease resistance with a high yielding ability

OBJECTIVE 9

Optional Activities/
Resources in
Instructor's Guide

Define genetic engineering.

WORDS YOU SHOULD KNOW	
genes	the chemical units that carry hereditary characteristics from parent to offspring

Genetic engineering, also known as biogenetics, entails the alteration of an organism's genes through human intervention.

Plants are genetically engineered so as to enhance, change, or add certain characteristics that affect endurance, freedom from disease, and/or crop yield.

OBJECTIVE 10

Optional Activities/
Resources in
Instructor's Guide

Define cloning.

WORDS YOU SHOULD KNOW	
cutting	any part which can be severed from a plant and be capable of growing on its own
grafting	inserting a piece of one plant into another or the same plant with the intention that it shall grow there
layering	(also known as layerage) the method of reproducing woody plants by covering portions of their stems or branches with moist soil or moss so that they take root while still attached to the parent plant

Cloning is the act of developing a group of genetically identical plants from a single plant through vegetative means (cuttings, grafting, or layering) rather than seeds.

EXAMPLE: Creating new rose bushes from the cuttings of existing roses

OBJECTIVE 11

Optional Activities/
Resources in
Instructor's Guide

Describe uses of defoliants and growth inhibitors.

WORDS YOU SHOULD KNOW

boll	the leathery capsule that contains the seed and lint of the cotton plant
defoliants	chemicals used to initiate the process by which leaves are removed from a plant
defoliate	loss of leaves either by natural means or the use of chemical defoliants
growth inhibitor	a nonnutrient substance used to slow down or stop plant growth or development
lodge	the act of field crops breaking, bending over, or lying flat on the ground, sometimes forming a triangle
nonnutrient	substance with no nutritive or food value

Defoliants are often used if there is still green foliage on cotton plants close to harvest time. Defoliation has proved advantageous to farmers in machine harvesting cotton, especially when spindle picker harvesters are used, because it:

- Helps lodged plants return to an erect position
- Removes leaves, which--if left--could clog the spindle, add trash to the harvest, and stain the fiber
- Accelerates the opening of mature bolls
- Reduces boll rot
- Reduces populations of insects which feed on leaves, thereby helping to eliminate the damage that insects can cause to the fiber

☑ **NOTE:** When alfalfa is harvested for seed a chemical is applied that causes the leaves and stems to dry out in order to make combining easier.

Growth inhibitors are used for the following purposes:

- To prevent lodging of wheat (by shortening the plant stem)
- To place nursery plants in a state of dormancy during shipping, in order to preserve quality
- To promote flowering, fruit ripening, and the removal of leaves
- To make the harvest of tree and vine fruits easier
- To ripen fruit uniformly before shipping
- To make cotton harvesting easier by slowing vegetative growth
- To increase the yield of such plants as cucumbers and pumpkins by stimulating the production of female flowers
- To slow the ripening process

OBJECTIVE 12 **Complete Assignment Sheet 1.**

OBJECTIVE 13 **Complete Assignment Sheet 2.**

ASSIGNMENT SHEET 1

GROWTH AND REPRODUCTION

D-1

Name ______________________________ Score __________

OBJECTIVE 12

Calculate the percent of germination to determine the rate of application.

INTRODUCTION

The percent of germination is determined by dividing the number of plants that successfully sprouted by the number of seeds that were planted. This looks like:

Number of plants sprouted ÷ Number of seeds planted = percentage of germination

EXAMPLE: 100 seeds were planted
90 plants sprouted

90 ÷ 100 = 90% germination

INSTRUCTIONS

Math Application

- Select/apply mathematical formula

Answer the questions below.

1. What would be the percentage of germination if 150 seeds were planted and 128 plants sprouted?

2. What would be the percentage of germination if 225 seeds were planted and 201 plants sprouted?

3. What would be the percentage of germination if 175 seeds were planted and 158 plants sprouted?

4. What would be the percentage of germination if 160 seeds were planted and 124 plants sprouted?

ASSIGNMENT SHEET 2

GROWTH AND REPRODUCTION

D-1

Name ______________________________ Score __________.

OBJECTIVE 13

Present an oral report on a recent development in plant or crop technology.

EQUIPMENT AND SUPPLIES

- Note cards
- Resources and references

INSTRUCTIONS

Reading Comprehension
- Gain factual information

Research and Reference
- Select useful resources
- Locate resources

Research
- Take notes
- Use note cards

Oral Presentation
- Make informative presentations
- Use good speaking techniques
- Use effective body language

1. Select a topic.

   Decide which recent development you are going to cover. You may want to refer to agricultural journals or to contact one of the following: your county extension office, a division of the United States Department of Agriculture (USDA), the Oklahoma Department of Agriculture (ODA), or the OSU Department of Agriculture. Be careful to choose a topic you can learn enough about to give a complete report.

2. Research the topic.

   Since you are giving a report on a recent development, you are unlikely to find much material at your local or school library, other than magazine or newspaper articles. Contact OSU, your county extension agent, or people in the division of the ODA or the USDA that oversees an area related to the topic you've chosen. Ask to interview them and also ask for any written information (fact sheets, pamphlets, brochures, etc.) that exists on the topic.

3. Take notes.

   Write each fact on a separate note card.

4. Arrange the note cards in order.

   Move the cards around until the information seems to flow logically.

5. Write an introduction.

   Your opening statement should get the audience's attention and tell them what you are going to talk about.

6. Write the body of the speech.

   The body of your speech should contain your main points. Each main point should be supported by facts, statistics, or direct quotes from an expert.

7. Write your conclusion.

   Your conclusion should make your point in one, easy to understand sentence.

8. Practice making the speech.

   A. Time yourself. Make sure your report lasts the assigned length of time.

   B. Don't write out your whole speech. It will sound stiff. Instead, memorize your introduction and conclusion, look at the facts on your note cards, and put everything in your own words.

OBJECTIVE SHEET

SEEDS AND PLANTS: SELECTION, PREPARATION, AND PLANTING

D-2

INTRODUCTION

The manner in which a farmer prepares soil and selects and plants seed are the single most important aspects of raising crops. Nothing else, at least nothing within the farmer's control, will have as large an impact on the size and quality of that farmer's crops or success--or failure--in business.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS	
PREREADING:	Read *Summer Tillage and Seedbed Preparation for Wheat*, OSU Current Report No. 2077.
WRITING:	Write a short essay (one paragraph to one page) on how summer tillage for wheat is conducted.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment and Job Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Select from a list guidelines for selecting high-quality seed.
2. State reasons for tillage.
3. Explain the purpose of various tillage systems.
4. Identify common crop seeds.
5. Identify characteristics of common plants.
6. Choose an appropriate site for a specified crop.
7. List factors affecting seeding rates.
8. Describe methods of planting.
9. Identify types of seeds. (Assignment Sheet 1)
10. Identify types of plants. (Assignment Sheet 2)
11. Determine tillage operation and practices. (Assignment Sheet 3)
12. Interpret seed tag information. (Assignment Sheet 4)
13. Select and prepare seed. (Job Sheet 1)
14. Calibrate planting equipment. (Job Sheet 2)
15. Calibrate a grain drill. (Job Sheet 3)
16. Plant a crop. (Job Sheet 4)

INFORMATION SHEET

SEEDS AND PLANTS: SELECTION PREPARATION, AND PLANTING

D-2

OBJECTIVE 1

Optional Activities/ Resources in Instructor's Guide

Select from a list guidelines for selecting high-quality seed.

WORDS YOU SHOULD KNOW	
certified	formally declared by a certifying agency to maintain varietal purity and be free from seed-borne pests
cultivar	a cultivated variety; a group of cultivated plants distinguished by any significant characteristic
germination	sprouting of a seed and beginning of plant growth

To obtain only high-quality seed, make sure any you purchase meets the following criteria:

- It is purchased from a reliable dealer.
- It has been certified by the state certified seed program.

  ☑ **NOTE:** Using certified or registered seed lessens the chance of seed outcrossing and of finding foreign material or a mixture of variety. It also helps give you a better product, keeps the strains purer, and improves yield.

- It is recommended by the certified seed program as a variety that can adapt to your area.
- It has a high percentage of germination (as shown on the seed tag).
- It has a high percentage of purity (also indicated on the seed tag), so that there is little if any inert matter, other crop seed, or weed seed present.

- It has little or no damage.

☑ **NOTE:** Seed sometimes receives "mechanical" damage during harvesting or processing, causing it to be cracked, broken, or chipped. Seed can also be damaged by insects and disease.

- It is plump and full-sized.
- It is the cultivar you desire.

OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

State reasons for tillage.

WORDS YOU SHOULD KNOW	
residue	part of the plant or crop left in the field after harvest
seedbed	the upper portion of the soil prepared by natural or artificial means to receive seed and to promote germination and growth
tillage	the mechanical manipulation of soil

Reasons for tillage include:

- Preparing a seedbed to allow the new crop seed to germinate and grow
- Killing weeds
- Helping to control insects and diseases
- Incorporating at least part of the residue of the previous crop into the soil
- Working other fertilizers into the soil
- Breaking up layers of compacted soil

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

Explain the purpose of various tillage systems.

WORDS YOU SHOULD KNOW	
fallow	cropland left idle in order to restore productivity through accumulation of moisture
primary tillage	deepest operation in tillage system; loosens and fractures soil to reduce soil strength and to bring or mix residues and fertilizers into tilled layer
secondary tillage	operation used to kill weeds, cut and cover crop residues, incorporate herbicides, and prepare a well pulverized seedbed
tillage system	the sequence of tillage operations performed in producing a crop

☑ **NOTE:** Different tillage systems are used for different soil types.

- Conservation tillage systems are used to produce, on or in the soil, conditions that resist erosive effects of wind, rain, and flowing water. These systems leave residue on the surface. Conservation tillage includes the following types of systems:

  ☐ Mulch tillage, which plants new crop while leaving residue on the surface to impede wind and retain water throughout the fallow period; any subsequent tillage is done for weed control

  EXAMPLE: Used in sandy and loamy types of soil

  ☐ Strip tillage, which tills a strip of soil where the row of crop is planted, so as to leave a space between rows to help with conservation

  EXAMPLE: Used with sandy soils

  - ☐ No-till, which leaves the soil undisturbed from harvest to seeding and from seeding to harvest; follow-up soil preparation is not required; uses herbicides as primary means of weed control

    EXAMPLE: Can be used with any type soil

  - ☐ Ridge-plant (also called ridge-till or till-plant), which leaves the soil undisturbed from harvest to planting except sometimes for fertilizer injection; used for crops planted and grown on preformed ridges

    EXAMPLE: Used on sandy soil

- Conventional tillage systems are used to prepare a seedbed and produce a given crop. These types of systems are called "conventional" because they are the systems traditionally or most commonly used in a given geographic area.

  EXAMPLE: Used with any type of soil

- Clean tillage cleans the surface of residue by incorporating previous crop residue into the soil soon after the harvest. Follow-up tillage is done for weed control and seedbed preparation. Clean tillage is a conventional system in some areas for certain crops.

  EXAMPLE: Heavier soils or soils with clay respond best to this type of tillage

- Reduced tillage includes any system that is less intensive and less aggressive than conventional tillage. As a result, either the number of operations is reduced or a tillage implement that uses less energy is substituted for the one typically used in the area.

  EXAMPLE: Used for sandy soils

  ☑ **NOTE:** Most tillage systems use both primary and secondary tillage. Changing from one type of tillage system to another usually means obtaining a different type of equipment, which can cost a lot of money.

771

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Identify common crop seeds.

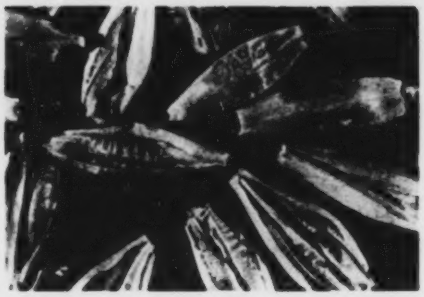
Seeds from 13 commonly grown plants are shown below in alphabetical order (Figures 1-13).

Alfalfa

FIGURE 1

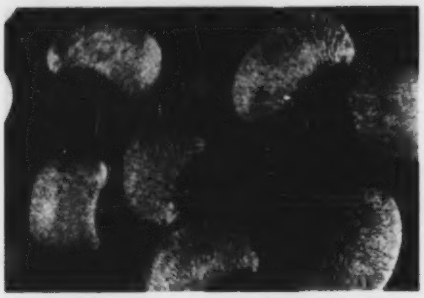
Barley

FIGURE 2



Blackeye cowpea

FIGURE 3



Clover

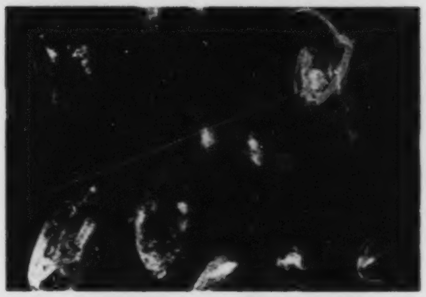
FIGURE 4

Corn

FIGURE 5

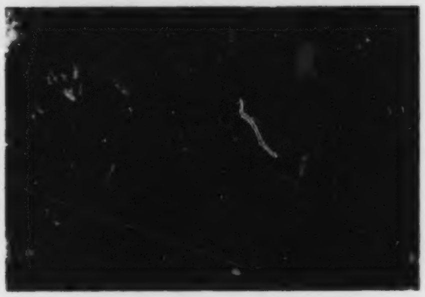
Cotton

FIGURE 6



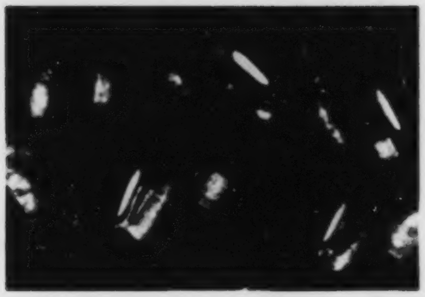
Lespedeza

FIGURE 7



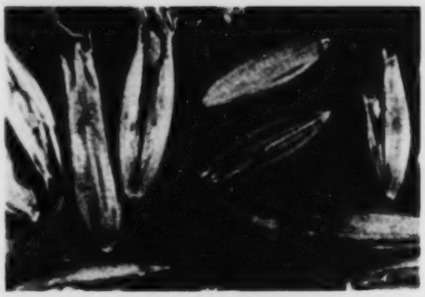
Mungbean

FIGURE 8



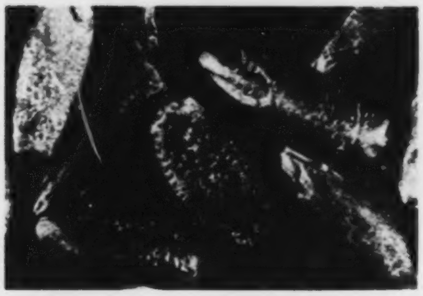
Oats

FIGURE 9



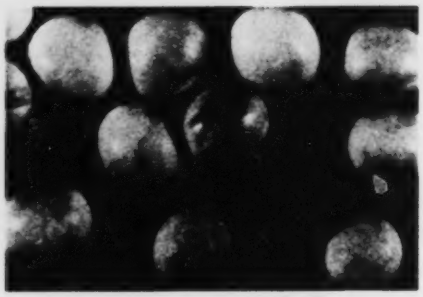
Rye

FIGURE 10



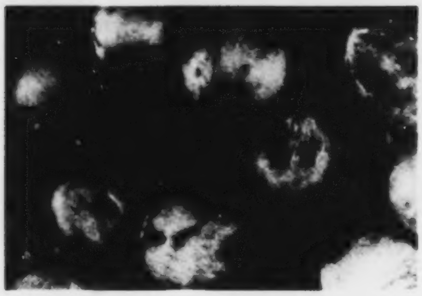
Soybean

FIGURE 11



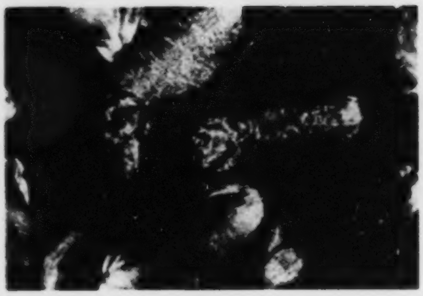
Sorghum

FIGURE 12



Wheat

FIGURE 13



OBJECTIVE 5

Identify characteristics of common plants.

Required Activities/
Resources
- Transparency Masters 1 and 2

Optional Activities/
Resources in
Instructor's Guide

You will see two transparencies showing characteristics of plants.

WORDS YOU SHOULD KNOW	
blade	the expanded portion of a leaf
dicot (dicotyledon)	plant whose seeds have two seed leaves, i.e., beans
monocot (monocotyledon)	plants like corn that have a single seed leaf (cotyledon)
petiole	the stem of a dicotyledonous leaf
sheath	the leaf base covering a stem or branch, such as the lower part of leaves of grasses which surround the stem

Common plants consist of four basic parts:

- Roots, types of which include:
    - ☐ Fibrous, which are very branched and finely divided and, depending on soil conditions, can vary from a few inches to 6 feet

      EXAMPLE: Grasses

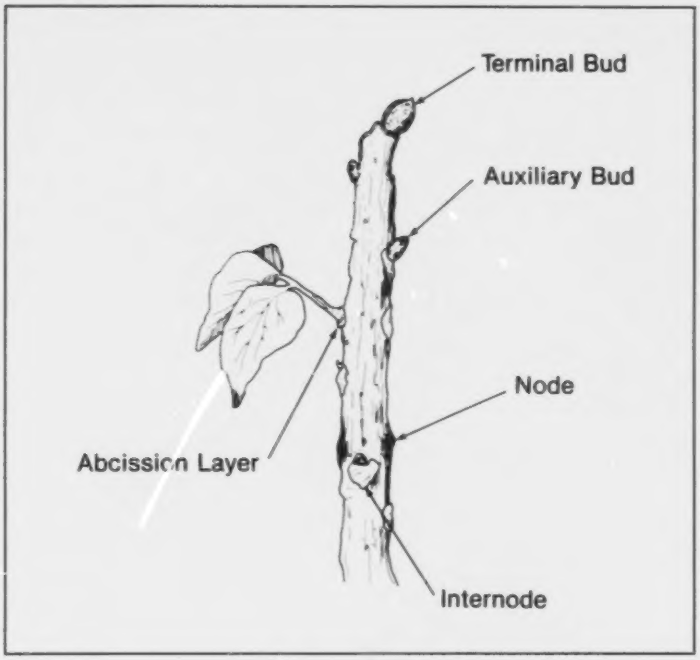
      ☑ **NOTE:** Very effective in holding plant in place and preventing erosion on steep slopes.
    - ☐ Taproot, which has one central large root with small side-branching roots; penetrates to greater depth than fibrous roots

      EXAMPLES: Alfalfa, clovers, and carrots

      ☑ **NOTE:** Central root allows a plant to reach deeper soil moisture during dry periods.

- Stems, parts of which are shown below (Figure 14):

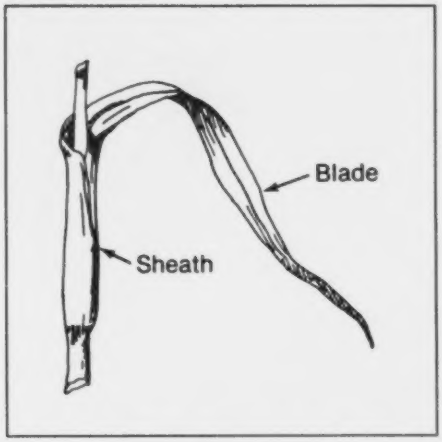
FIGURE 14


Terminal Bud
Auxiliary Bud
Node
Abcission Layer
Internode

- Leaves, the types of which include:
  - ☐ Monocots - composed of a sheath and blade, with the sheath attaching the usually long, narrow, thin, and pointed blade to the main stem

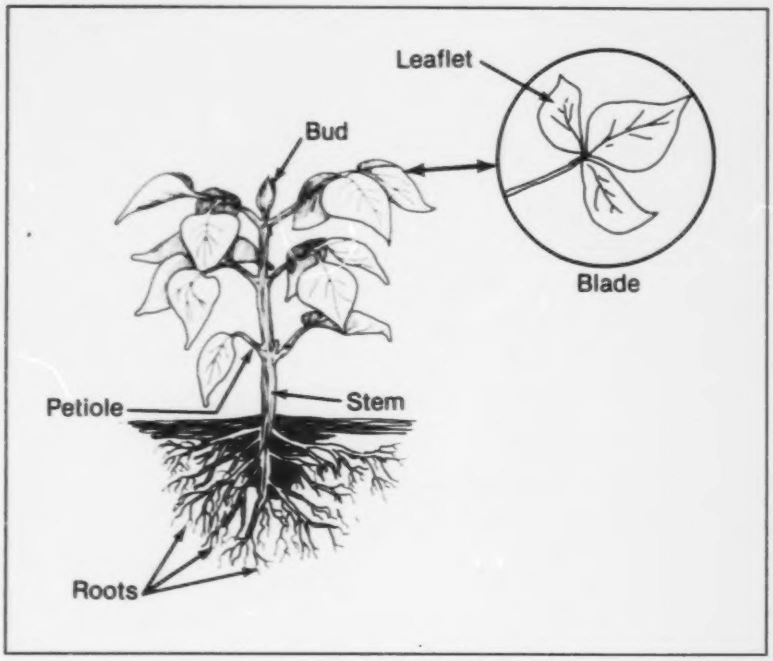
    EXAMPLE:

    FIGURE 15


Blade
Sheath

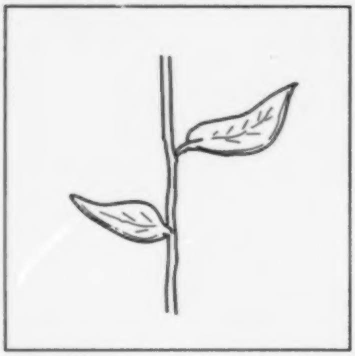
- ☐ Dicots - composed of blade and petiole, with the petiole attaching the blade (usually composed of two or more leaflets) to the main stem (Figure 16) in the following leaf-to-stem attachment patterns:

FIGURE 16


Leaflet
Bud
Blade
Petiole
Stem
Roots

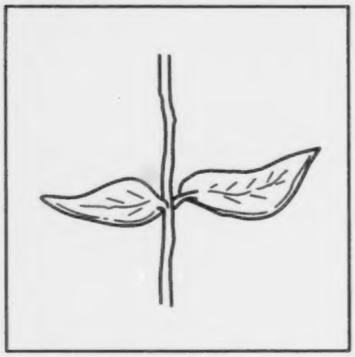
- Alternate - one leaf at each node

FIGURE 17



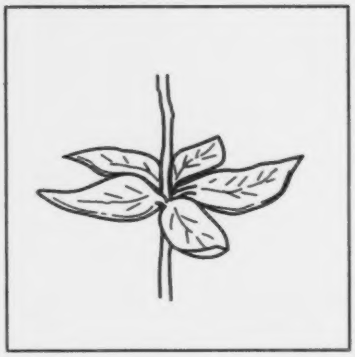
- Opposite - two leaves, opposite to each other, at each node

FIGURE 18



- Whorled - three or more leaves at each node

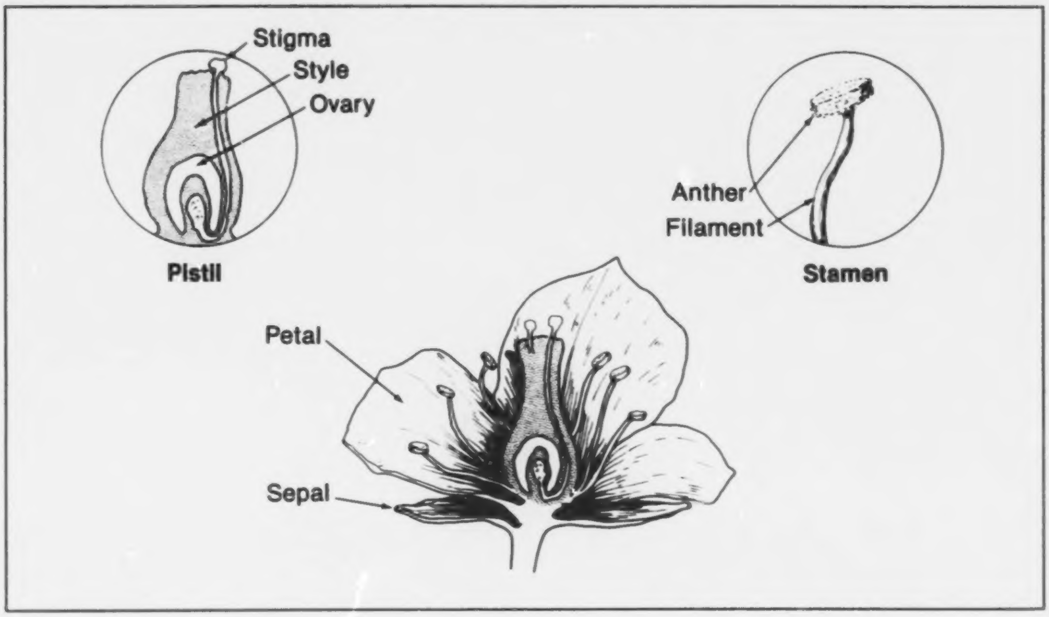
FIGURE 19



773

- Buds or flowers, the parts of which are shown below:

FIGURE 20


Stigma
Style
Ovary
Pistil
Anther
Filament
Stamen
Petal
Sepal

☑ **NOTE:** Flowers serve as the organ of sexual reproduction in plants.

779

OBJECTIVE 6

Optional Activities/
Resources in
Instructor's Guide

Choose an appropriate site for a specified crop.

WORDS YOU SHOULD KNOW	
acidity	the measure of how many hydrogen ions a solution contains; level of acid
organic	produced by plants or animals

- To grow properly, cotton needs:
  - ☐ A warm to hot climate
  - ☐ A growing season with 200 or more days a year in which temperatures do not drop below freezing
  - ☐ Fertile, well-drained soil that gets adequate moisture during the growing season
  - ☐ Soil rich in nitrogen, potassium, and phosphorous

    ☑ **NOTE:** Nutrients can be added to soil through fertilizer.
- Wheat requires:
  - ☐ A fairly dry and mild climate
  - ☐ Clay loam or silt loam soil for optimal results
  - ☐ Soil with much decayed organic matter to provide food for the plants
  - ☐ Soil that is either rotated out with clover, corn, oats, soybeans, or timothy or (in an area with little rainfall) allowed to lay fallow every other year

    ☑ **NOTE:** If soil has too much acidity or lacks the necessary nutrients, wheat won't grow well in it and may not even sprout.
  - ☐ Rotating other crops with wheat not only returns nutrients to the soil but also helps reduce pests and diseases.

- Soybeans need:
  - Fertile, well-drained soil
  - At least 20 inches of rain during the growing season
- Rye
  - Is frequently grown to improve or protect soil
  - Especially valuable where soil contains sand or peat
- Oats
  - Grow especially well in areas that have a cool, moist climate and fertile soil
  - Usually planted in February (spring oats are the most common oat grown)
  - Can be planted in fall and harvested the next summer (winter oats)

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

List factors affecting seeding rates.

WORDS YOU SHOULD KNOW	
excreted	to separate and expel from an organism
nutrients	an element or compound which is essential for the growth of a plant

The major factors that affect seeding rates are:

- Available moisture

  ☑ **NOTE:** There must be sufficient moisture to supply the plant population with food. The moisture can be supplied by either rainfall or irrigation. More moisture is needed in hot, dry climates because water vapor is excreted to the atmosphere by plants.

- Fertility of the soil

  ☑ **NOTE:** The soil can't supply the plants with enough food to develop fully if it lacks sufficient nutrients. Fertilizer is sometimes added to the soil to increase the nutrient supply. The amount of fertilizer added depends on the soil's level of nutritional deficiency and on whether profits would increase by adding more fertilizer.

- Germination

  ☑ **NOTE:** Some seeds will always fail to successfully germinate. As a result, the seeding rate should be adjusted based on the percentage of seeds expected to germinate.

- Planting time

  ☑ **NOTE:** If seed is planted during the wrong time of year, the crop may be less than normal or may not come up at all. Seed usually needs certain temperatures, amount of sunlight, rain, etc., to properly germinate and grow. As a result, it should be planted at the time of year when the desired conditions are most likely to occur.

- Row spacing

  ☑ **NOTE:** There will be too much competition for nutrients and sunlight if seeds are planted too close together. This results in stunted crops that don't reach their full maturity and which are usually weak and susceptible to lodging, diseases, and insect damage.

- Planter operation

  ☑ **NOTE:** The mechanical condition of the planter, how the planter is adjusted, and the speed at which the planter is pulled through the field all cause the seeding rate to vary.

OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

Describe methods of planting.

WORDS YOU SHOULD KNOW	
bed	a plot of land raised above the surrounding soil
furrow	opening left in soil after soil is cut, raised, and inverted by a moldboard plow
stand	the relative number of plants per area rated as poor, good, or medium based on the number of plants; the higher the number of plants, the higher the rating of the stand

There is a need for a variety of planting methods because rainfall, temperature, and soil vary a great deal from one geographic area to another. As a result, three methods of planting have been developed to obtain the correct moisture and seedbed environment for newly-planted seeds. These methods include:

- Planting on dry land
  - ☐ Used in areas where rainfall is sufficient to grow a crop without using any irrigation
- Planting in beds
  - ☐ Used where there is either too much moisture prior to planting or it is desirable to apply irrigation water in furrows between beds
  - ☐ Causes the tops of the beds or ridges to dry sooner, permitting earlier planting than that which is possible with dry-land planting
  - ☐ Results in an improved stand, improved germination of the seed, and a quicker emergence of the plants
- Planting in furrows
  - ☐ Used in areas where rainfall is limited during growing season

- Collects rainfall in furrows that would otherwise have run off the land
- Easily irrigated (using surface ditch systems) when soil moisture falls below acceptable level

OBJECTIVE 9 **Complete Assignment Sheet 1.**

OBJECTIVE 10 **Complete Assignment Sheet 2.**

OBJECTIVE 11 **Complete Assignment Sheet 3.**

OBJECTIVE 12 **Complete Assignment Sheet 4.**

OBJECTIVE 13 **Complete Job Sheet 1.**

OBJECTIVE 14 **Complete Job Sheet 2.**

OBJECTIVE 15 **Complete Job Sheet 3.**

OBJECTIVE 16 **Complete Job Sheet 4.**

ASSIGNMENT SHEET 1

SEEDS AND PLANTS: SELECTION, PREPARATION, AND PLANTING

D-2

Name ______________________________ Score __________

OBJECTIVE 9

Identify types of seeds.

EQUIPMENT AND SUPPLIES

- Handout 1, *Commonly Recognized Classes of Seed*

INSTRUCTIONS

Reading Comprehension
- Gain factual information
- Draw conclusions

Read Handout 1, then answer the following questions by filling in the blanks:

1. Seed that comes with a blue tag is __________________.
2. Seed that is unavailable to the general public is known as __________________.
3. Seed that comes with a purple tag is ________________.
4. The most commonly available seed is ________________.
5. This seed is developed from breeder's seed ______________.
6. Seed that comes with a white tag is __________________.
7. __________________ is comprised of a limited amount used to maintain a genetically pure source of a strain or cultivar.

ASSIGNMENT SHEET 2

SEEDS AND PLANTS: SELECTION, PREPARATION, AND PLANTING

D-2

Name ______________________________ Score __________

OBJECTIVE 10

Identify types of plants

EQUIPMENT AND SUPPLIES

- Handout 2, *Plant Classifications Based on Life-Cycle of Plants*

INSTRUCTIONS

Reading Comprehension
- Gain factual information
- Draw conclusions

Review Objective 6 of Unit D-1 and read Handout 2, then answer the following questions by filling in the blanks:

1. ________________ consist of plants grown for their seed or grain to be used for food or feed.
2. ________________ require two years or two growing seasons to complete their life cycle.
3. (A) An ______________ germinates, grows, reproduces, matures, and dies within one year.
4. __________________ are grown for their leaf or plant parts and used as livestock feed.
5. Any member of the grass family grown for its edible fruit or seed is a ____________________.
6. _____________________ are grown for the vegetable oil and concentrated protein found in their seed.
7. Plants grown for their sugar production are classified as __________________.
8. __________________ are grown for their underground storage organs.
9. _______________ survive more than two years, usually producing seeds each year and then becoming dormant before starting new vegetative growth and repeating the cycle.

10. Cotton and flax are examples of ____________________, plants grown for the materials they provide for clothing and shelter.

11. ____________________ are grown for something other than a source of fiber or food for humans or animals.

12. ____________________ germinate in the fall, lie dormant over the winter, then mature, set seeds, and die in spring or early summer.

ASSIGNMENT SHEET 3

SEEDS AND PLANTS: SELECTION, PREPARATION, AND PLANTING

D-2

Name ______________________________ Score __________

OBJECTIVE 11 **Determine tillage operation and practices.**

INSTRUCTIONS

In this Assignment Sheet you are asked to recall the information provided in objective 3 on the various tillage systems. You also have the opportunity to make decisions based on the circumstances given.

Reading Comprehension
- Gain factual information

Read through the Assignment Sheet and answer the questions presented.

Earth Science
- Investigate conservation of physical resources

Cognitive Activities
- Draw conclusions

Wheat producer Jack Walters has just harvested a good wheat crop. He plans to let the land lay idle over the summer and to plant wheat again in the fall. Jack, like the other wheat producers in his area, has traditionally used a clean-till system, but is considering changing to another tillage system because he has had some problems with wind erosion. Also, some years the top soil moisture has been lacking at planting time in the fall.

1. The term for allowing land to lie idle for a period of time is ____________________.

2. What did Jack's system of tillage do to the surface of his soil?

   ____

3. Since the clean-till system had traditionally been used by Jack and the other wheat producers in his area, how else might it be classified?

   ____

4. What type of tillage system would you recommend Jack implement and why?

5. What might make it difficult for Jack to implement a different tillage system?

ASSIGNMENT SHEET 4

SEEDS AND PLANTS: SELECTION, PREPARATION, AND PLANTING

D-2

Name ______________________________ Score __________

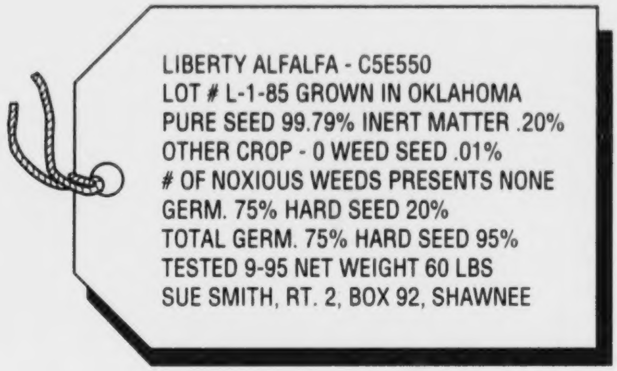
OBJECTIVE 12 **Interpret seed tag information.**

EQUIPMENT AND SUPPLIES

- Handout 3, *Interpretation of Information on Commercial Seed Tags*

INSTRUCTIONS Study Handout 3, then review the seed tag below and answer the questions that follow.

Functional Reading
- Interpret forms and records
- Use content area vocabulary



LIBERTY ALFALFA - C5E550
LOT # L-1-85 GROWN IN OKLAHOMA
PURE SEED 99.79% INERT MATTER .20%
OTHER CROP - 0 WEED SEED .01%
# OF NOXIOUS WEEDS PRESENTS NONE
GERM. 75% HARD SEED 20%
TOTAL GERM. 75% HARD SEED 95%
TESTED 9-95 NET WEIGHT 60 LBS
SUE SMITH, RT. 2, BOX 92, SHAWNEE

1. What is the origin of this seed sample?

____

2. What is the crop?

____

3. What is the cultivar?

____

4. This sample contains ______% inert matter.

5. There is ______% weed seed in this sample.

6. This sample has ______ noxious weeds present.

7. The actual germination rate was ______%.

8. ______% of the seed were found to be hard seed.

9. The date of the germination test on this seed was ___________.

10. What is the weight of contents?

____

JOB SHEET 1

SEEDS AND PLANTS: SELECTION, PREPARATION, AND PLANTING

D-2

Name ______________________________

OBJECTIVE 13

Select and prepare seed.

EQUIPMENT AND SUPPLIES

- Adequate transportation to carry seed back from store

PROCEDURE

Job Acquisition/ Development
- Master specific job task/procedure

Yes No

1. Selected seed that has been certified by the state certified seed program. ____ ____
2. Checked seed tag for a high percentage of germination. ____ ____
3. Checked seed tag for a high percentage of purity. ____ ____
    a. A low percentage of weed seed ____ ____
    b. A low percentage of other crop seed ____ ____
    c. A low percentage of inert matter ____ ____
4. Checked seed tag and determined that the seed is the cultivar that you want to buy. ____ ____
5. Visually checked the seed to make sure it has little or no damage. ____ ____
6. Visually checked the seed to make sure it is plump and full-sized. ____ ____
7. Store the seed in a cool, dry place. ____ ____
8. Have your instructor check your work. ____ ____

SKILL TEST RECORD

EVALUATOR'S COMMENTS

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Purchased desired seed	4 3 2 1
Seed was certified and in good condition	4 3 2 1
Stored properly	4 3 2 1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

4 **Skilled** – Can perform job with no additional training.
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
1 **Unskilled** – Is familiar with process, but is unable to perform job.

EVALUATOR'S COMMENTS

Name ______________________________

OBJECTIVE 14

Calibrate planting equipment.

INTRODUCTION

Two methods can be used to check planting equipment. The FIRST METHOD is reasonably accurate and is used when the producer wants to "fine tune" the planter. The SECOND METHOD is less accurate than the first, but faster. It provides a quick means of roughly checking the planting rate to see if the planter is planting at close to the desired rate. This Job Sheet will give you the chance to learn how to use both methods.

EQUIPMENT AND SUPPLIES

- Planter
- Operator's manual for planter
- Handout 4, Row Length Per Acre Table and Second Method Factor Chart
- Tape measure
- Heavy work gloves (if seed is treated with insecticides)
- Paper and pencil
- Battery-operated calculator (optional)

PROCEDURE

Functional Math
- Solve practical problems

Job Acquisition/ Development
- Master specific job task/procedure

Yes No

FIRST METHOD

1. Fill the planter's seed hoppers at least half full with seed to simulate an average planter's weight. ____ ____
2. If recommended by the planter's operation manual, add powdered graphite to the hoppers. ____ ____
3. Mark a row distance equal to 1/1000 acre (refer to Row Length Per Acre table). ____ ____

Yes No

4. Plant the measured distance at the speed you intend to use during planting, being sure to start planting before reaching the first mark and continuing past the last mark (to simulate accurate field conditions). ____ ____

5. Uncover the seeds within the measured distance and count them. ____ ____

6. To learn the planting population for one acre, multiply the number of seeds by 1,000. ____ ____

7. To ensure accuracy, check each row. ____ ____

8. Measure planting depth with tape measure. ____ ____

9. Check the average distance between seed to determine accurate seed placement. ____ ____

10. Following instructions in the planter's operations manual, make required adjustments for the rate of seeding and depth of planting. ____ ____

11. Recheck by repeating steps 1 through 4. ____ ____

SECOND METHOD

1. Repeat steps 1 through 3 of the First Method. ____ ____

2. Using your tape measure, measure 3 feet along each row. ____ ____

Yes No

3. Count the number of seeds uncovered in this distance and determine the average number of seeds found per row. ____ ____

EXAMPLE: If the row spacing is 30 inches (the Second Method Factor chart shows the multiplying factor for that spacing is 5.81). If you planted six rows and counted 5 seeds in the first row, 4 in the second, 4 in the third, 5 in the fourth, 4 in the fifth, and 4 in the sixth, your equation would appear as follows:

$5 + 4 + 4 + 5 + 4 + 4 = 26$
$26 \div 6 = 4.33$ average seeds

4. To learn the total number of seeds that would be planted per acre, multiply the average number of seeds by the appropriate factor shown in the Second Method Factor chart and multiply by 1,000. ____ ____

EXAMPLE:

seeds per acre = average # seeds per row x Factor x 1,000

(using the same figures shown in the example above)

= 4.33 x 5.81 x 1,000
= 25,157 seeds per acre

5. Repeat steps 8 through 11 from the First Method. ____ ____

6. Have your instructor check your work on both methods. ____ ____

797

SKILL TEST RECORD

EVALUATOR'S COMMENTS

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Filled seed hoppers correctly	4 3 2 1
Followed operator's manual instructions	4 3 2 1
Accurately measured depth	4 3 2 1
Accurately figured calculations	4 3 2 1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

4 **Skilled** – Can perform job with no additional training.
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
1 **Unskilled** – Is familiar with process, but is unable to perform job.

EVALUATOR'S COMMENTS

799

JOB SHEET 3

SEEDS AND PLANTS: SELECTION, PREPARATION, AND PLANTING

D-2

Name ______________________________

OBJECTIVE 15

Calibrate a grain drill.

INTRODUCTION

You need to know how to calibrate a grain drill in order to accurately determine seeding or fertilizer rates. Three different methods of calibration can be used to check the quality of seed drilled per acre. The first two methods involve seeding in weight per acre. The second method offers a more accurate check on the seeding rate than the first. The third method is for seeding in seeds per acre.

EQUIPMENT AND SUPPLIES

- Tractor
- Grain drill
- Operator's manual for grain drill
- Handout 5 (Drilling Distance for 1/10 Acre)
- Heavy work gloves (if seed is treated with insecticides)
- Paper and pencil
- Battery-operated calculator (optional)
- Scale that will measure in grams

PROCEDURE

Functional Math
- Solve practical problems

Job Acquisition/ Development
- Master specific job task/procedure

FIRST METHOD	Yes	No
1. Make all feed adjustments as shown on the grain drill seed chart in the operator's manual or on the hopper lid.	____	____
2. In the field fill the seed hopper full, then pull the drill a short distance to settle the seed. Refill the hopper, as necessary, to make it full and level.	____	____
3. Drill as close to 1/10 acre as you can calculate (for low seeding rates either use a larger fraction of an acre or a full acre). Refer to Handout 5 to learn drilling distance.	____	____

	Yes	No
4. Carefully weigh the amount of seed needed to refill the hopper to a level-full amount. Multiply that amount by 10 (or whatever amount needed) to learn how much would be needed for one acre.	____	____
5. Compare the weight of seed needed to refill the hopper with the weight shown on the grain drill seed chart referred to in Step 1.	____	____
6. Make any adjustments needed to set the feed-cup at the level needed to compensate for any variation between the amount you actually drilled and the amount shown in the chart.	____	____
SECOND METHOD		
1. Jack up the drive wheel.	____	____
2. Either place seed in the hopper or place seed collected in sacks at each seed tube. Also place a tarp or canvas under all feeds.	____	____
3. Referring to the seed chart, set the feed-cup on the drill for the desired quantity per acre.	____	____
4. Turn the drill wheels the required number of times for 1/10 acre, as calculated per the following formula:	____	____

$$\text{Rotations to equal } 1/10 \text{ acre} = \frac{8319.3}{W \times D}$$

W = Drilling width in feet

D = Diameter of wheel in inches (rolling diameter)

EXAMPLE: If a grain drill is 16 X 7 and the drive wheel rolling diameter is 28 inches the rotation equation would look as follows:

$$W = \frac{16 \times 7}{12} = \frac{112}{12} = 9.33 \text{ feet}$$

D = 28 inches

Yes No

Rotations for 1/10 acre = $\frac{8319.3}{W \times D} = \frac{8319.3}{9.33 \times 28}$

$= \frac{8319.3}{261.24} = 31.8$ or about 32 rotations

5. Carefully weigh the collected seed, then compare it to the weight shown on the seed chart. (Divide the weight shown in the chart by 10 since the calibration was figured per 1/10 acre). ____ ____

6. Adjust the feed cup to whatever setting is necessary to compensate for variation and repeat the test until the desired quantity is obtained. ____ ____

THIRD METHOD

For this method, first determine the following:

- row spacing
- number of openers
- tire size and type
- type and size of seed
- operating speed

1. Count and weigh 500 seeds. ____ ____

2. Determine the number of seeds per pound using the following method: ____ ____

   seeds per pound = (454 grams/lb) X (500 seeds) ÷ weight of 500 seeds

   = 227,000 ÷ weight of 500 seeds

   So, if 500 seeds weigh 135 grams the equation would look like this:

   Seeds per pound = 227,000 ÷ 135 = 1681

Yes No

3. Determine seeding rate, in pounds per acre, for a desired population of 160,000 plants per acre. ____ ____

   Pounds per acre = desired plant population per acre ÷ number of seeds per pound

   = 160,000 ÷ 1681 = 95

4. For fluted-feed set the shift lever for the desired seeding rate (using charts in the operator's manual). ____ ____

   For double-run set countershaft gear clusters so they correspond with the proper drive number. ____ ____

5. For fluted-feed use the operator's manual to set the feed-cup gate to match seed size and type. ____ ____

   For double-run set the lock lever in the position indicated in the operator's manual seeding chart. ____ ____

6. Use the chart in the operator's manual to find the number of tire revolutions per 1/10 acre. ____ ____

7. Follow steps 1 through 4 in the second method. ____ ____

8. Obtain the conversion factor by dividing the weight of the seed collected by the actual setting: ____ ____

   Actual Wt. Metered = Conversion Factor
   Actual Setting

9. To determine the proper index setting for the seed, divide the desired weight per acre by the conversion factor: ____ ____

   $\frac{\text{Desired weight/acre}}{\text{Conversion Factor}} = \text{Proper setting}$

	Yes	No
10. For fluted-feed seed set the feedshift lever to get the desired rate. If necessary, verify this new setting by repeating the seed collection and weighing procedure.	____	____
For double-run adjust the seeding rate by moving the lock lever to a higher or lower numbered setting.	____	____
11. Have your instructor check your work on all three methods.	____	____

SKILL TEST RECORD

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Filled seed hoppers as directed	4	3	2	1
Followed operator's manual instructions	4	3	2	1
Accuracy of measurements	4	3	2	1
Accuracy of calculations	4	3	2	1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

4 **Skilled** – Can perform job with no additional training.
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
1 **Unskilled** – Is familiar with process, but is unable to perform job.

EVALUATOR'S COMMENTS

____

____

____

JOB SHEET 4

SEEDS AND PLANTS: SELECTION, PREPARATION, AND PLANTING

D-2

Name ______________________________

OBJECTIVE 16

Plant a crop.

EQUIPMENT AND SUPPLIES

- Tilled field
- Seed
- Tractor
- Tractor's operations manual
- Planter
- Planter's operations manual (if separate from tractor operations manual)

⚠ DANGER: SERIOUS INJURY OR DEATH POSSIBLE. Follow all safety precautions when around tractors.

PROCEDURE

Job Acquisition/ Development
- Master specific job task/procedure

	Yes	No
1. Following the tractor's operations manual:		
a. Make sure wheel spacing is correct	____	____
b. Make any necessary drawbar adjustments	____	____
c. Make any needed three-point hitch adjustments	____	____
d. Make sure front-end weights are correct	____	____
2. Following the planter's operations manual:		
a. Level the planter	____	____
b. Adjust the planter's row spacing, as needed	____	____

	Yes	No
c. Adjust the planter's marker length, if necessary		
d. Make any needed adjustments to the planter's seeding rate		
e. Make any necessary adjustments to the planting depth		
f. Clean planter, making sure there are no obstructions that would keep the mechanism from operating properly		
g. Calibrate the planter (Job Sheet 2)		
3. Fill the planter's seed hoppers to specified level with seed.		
4. Once you reach the point where you want to start planting, lower the planter.		
5. Check the depth of planting and kernel spacing during first round.		
6. Check planters performance occasionally to be sure accuracy is maintained.		
7. Observe level of seed in hoppers to make sure it is being metered properly.		
8. Empty and clean hoppers.		
9. Have instructor inspect field and machinery.		

SKILL TEST RECORD

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Safety procedures followed	4 3 2 1
Checked and prepared tractor	4 3 2 1
Checked and prepared planter	4 3 2 1
Properly filled seed hoppers	4 3 2 1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

4 **Skilled** – Can perform job with no additional training.
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
1 **Unskilled** – Is familiar with process, but is unable to perform job.

EVALUATOR'S COMMENTS

809

OBJECTIVE SHEET

COMMON PESTS

D-3

INTRODUCTION

Pests are a major problem for crop producers. Pests are an economic concern for both producers and consumers. Millions of dollars are spent per year on controlling pests and crop quality and yield are lowered because of pests. Understanding problems such as insects, weeds, and plant diseases will better help the crop producer control and prevent them.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS

PREREADING:	Read OSU Extension Fact Sheet No. 7183, *The Russian Wheat Aphid in Oklahoma* or No. 7184, *Alfalfa Aphids in Oklahoma.*
WRITING:	Write a short essay (one page) on one type of aphid and why it is a concern for Oklahoma crop producers.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Define pest.
2. Explain how pests affect plant and crop growth.
3. Label the stages in the life cycle of common insects.
4. Discuss types of insect damage.
5. Identify insects common to particular crops.
6. Identify insect damage in common field crops. (Assignment Sheet 1)
7. State ways weeds hinder crop production.
8. Identify common weeds.
9. Discuss bird and wildlife damage.
10. Select from a list indications of plant diseases.
11. Match causes of infectious plant diseases to their correct descriptions.
12. Identify diseases in common field crops. (Assignment Sheet 2)

INFORMATION SHEET

COMMON PESTS

D-3

OBJECTIVE 1

Optional Activities/
Resources in
Instructor's Guide

Define pest.

A **pest** is any undesirable or destructive organism such as destructive insects, rodents, undesirable bacteria, fungus, and weeds.

☑ **NOTE:** Not all insects, birds, and mammals are considered pests. In fact, some insects and birds are beneficial to the crop producer because they help control pests.

OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

Explain how pests affect plant and crop growth.

☑ **NOTE:** The damage that pests have on plant and crop growth ranges from minor to severe damage or even death of the plant.

- Pests that cause plant diseases disrupt normal cell functions, cause poor growth and health, can cause root rots, wilt, and decline or death of the plant.
- Some insects can damage or even kill plants. Insects affect the health of a plant by chewing and piercing plant parts causing poor growth and lower crop yields.
- Weeds may affect plant growth by competing with the plant for vital resources, such as sunlight and moisture.
- The presence of pests is of economic concern. Producers spend millions of dollars each year to control pests. Overall crop yields are often lower because of damage by pests.

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

Label the stages in the life cycle of common insects.

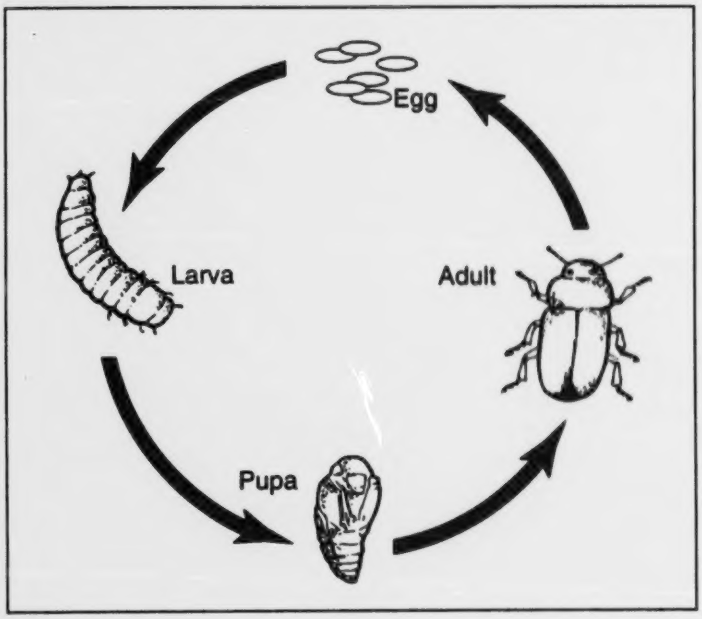
There are two main types of life-cycles for insects: the four-stage or "complete" life-cycle, and the three-stage or "incomplete" life-cycle. (Figures 1 and 2)

- The four-stage life-cycle includes:
    - □ The egg
    - □ The larva – the larva stage is the active eating and growing stage; larvae generally have biting mouth parts

      ☑ **NOTE:** The larva stage is the stage when many insects are most damaging to crops.
    - □ The pupa – the larvae pupate and go through changes from which the adult insect emerges
    - □ The adult

      ☑ **NOTE:** Adult insects may feed on and damage crops but in general are not as destructive as the larvae.

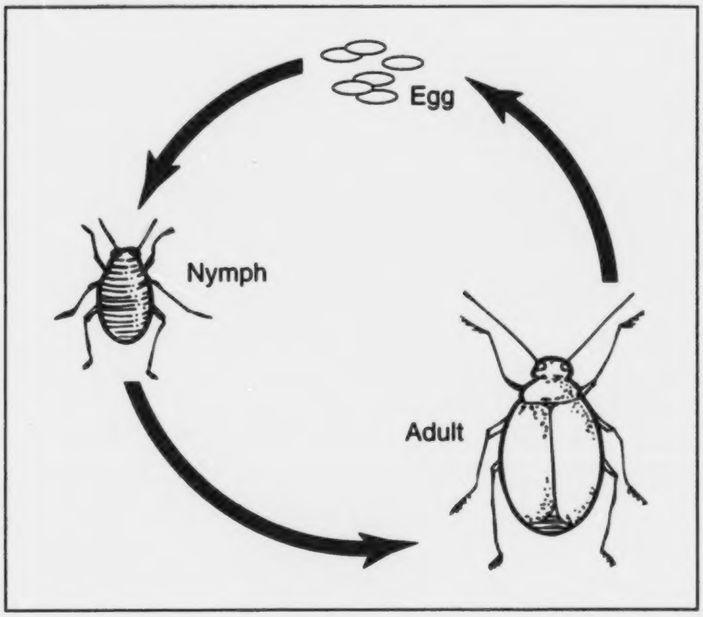
FIGURE 1



- The three-stage life-cycle includes:
  - ☐ The egg
  - ☐ The nymph – this stage is the active eating and growing stage; it is similar in appearance to the adult insect but is smaller and may not have wings
  - ☐ The adult – adult insects will feed on and damage crops

  EXAMPLE: Aphids

FIGURE 2



☑ **NOTE:** It is important to know the stages because some insecticides and other control methods are designed to kill insects at a certain life-cycle stage.

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Discuss types of insect damage.

WORDS YOU SHOULD KNOW	
aphid	an insect that has a small pear-shaped, soft body from the family *Aphididae*; aphids suck plant juices and often gather in large numbers
armyworm	larvae or caterpillars migrate to find food when vegetation is minimal in one area; feed on numerous plants and can cause severe damage; the fall armyworm is similar and gets its name from its fall appearance in some states
cutworms	pests from the family *Noctuidae*; the larvae cut stems of plants at ground level
defoliation	removal of plant leaves or parts of plant leaves
mites	mites are eight-legged and technically in the Arachnida class (with spiders and ticks); mites that attack plants are the spider mites and gall mites

☑ **NOTE:** Insects which damage crops are of two general types: chewing insects and sucking insects. Chewing insects directly cause injury to the plant by eating leaves or burrowing into leaves, stems, fruit or roots. Some chewing insects may also lay eggs on the plant which are later eaten by the larvae. Sucking insects have mouth parts and cause plant injury by piercing plant tissue and sucking out sap. The plant suffers because of loss of fluids and also from viruses, fungi, and bacteria which can enter through the punctures.

- Chewed or tattered foliage or blossoms – This damage is most often caused by insects that have chewing mouthparts such as larvae of moths, butterflies, and sawflies; adult beetles; and grasshoppers.

- Stippled, Flecked, or Discolored Foliage – This damage is caused by the insertion of sucking mouthparts into the leaf; the plant sap is removed and chlorophyll is withdrawn. Small areas of discoloration appear on the plant. If the insect problem is severe the discoloration will cause the plant to appear bleached, yellowed, bronzed, or silvered. Insects that cause this type of damage include leafhoppers, plant bugs, aphids, mealybugs, and spider mites.

- Distortion of plant parts – This damage can cause curled or cupped leaves, twisted growing points, or galls. This damage is often caused by aphids, thrips, larvae.

- Dieback of plant parts – This damage is often caused by scale insects, larvae of boring beetles or moths, or gall wasps.

☑ **NOTE:** Insects often leave products behind which are further evidence of their presence. Some common insect products include honeydew, dark fecal spots, tents or webs, cottony waxy material, and sawdust.

OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Identify insects common to particular crops.

ALFALFA

- Alfalfa weevil

  ☑ **NOTE:** Weevils cause defoliation. The alfalfa weevil is the most important pest of alfalfa in Oklahoma.

- Clover leaf weevil

- Pea aphid

- Spotted alfalfa aphid

- Blue alfalfa aphid

  ☑ **NOTE:** Aphids cause yellowing and death of leaves and stunting of growth. They are fluid feeding insects and damage plants by piercing the foliage and sucking sap.

- Army cutworm

- Fall armyworm

  ☑ **NOTE:** The army cutworm and fall armyworm cause damage in the larval stages by defoliation and may remove all plant growth above the soil surface.

- Variegated cutworm

  ☑ **NOTE:** The variegated cutworm often causes damage to new growth after cutting.

- Grasshopper

  ☑ **NOTE:** Grasshoppers cause defoliation.

- Defoliating caterpillars

- Potato leafhoppers

  ☑ **NOTE:** Potato leafhoppers cause damage similar to aphids.

- Alfalfa seed chalcid

- Blister beetles

  ☑ **NOTE:** Blister beetles produce cantharidin, a secretion that is toxic to horses that consume hay containing the bodies of blister beetles killed in harvesting.

CORN

- Seed-corn maggots

- Seed-corn beetles

- Wireworms

- Cutworms

- Corn rootworms

  ☑ **NOTE:** The larvae of corn rootworms feed on the roots.

- Chinch bugs

  ☑ **NOTE:** The young nymphs of chinch bugs damage plants by sucking sap from the plants. They feed by piercing the plant tissue.

- Fall armyworms

- Grasshoppers

- Corn earworms

  ☑ **NOTE:** The larvae of corn earworms feed on the silks or migrate to other parts of the plant.

- Flea beetles

- Mites

- Southwestern corn borer

  ☑ **NOTE:** The larvae of Southwestern corn borer feed on leaves and may enter the stalk.

- White grub

COTTON

- Cotton aphid

  ☑ **NOTE:** Cotton aphids cause damage by sucking sap from plant tissue.

- Beet armyworm

- Boll weevil

- Bollworm/budworm

- Looper

- Flea hopper

- Mites

- Thrips
- Grasshopper

PASTURE AND RANGE

- Grasshopper
- Fall armyworm
- Climbing cutworms

PEANUTS

- Southern corn rootworms
- Lesser cornstalk borers
- Spider mites
- Thrips
- Leafhoppers
- Rednecked peanutworms
- Corn earworms
- Granulate cutworms
- Fall armyworms
- Beet armyworms
- Blister beetles
- Yellow-striped armyworm
- Cabbage looper
- Grasshopper

SMALL GRAINS

- Armyworm
- Grasshopper
- White grubs
- Pale western cutworm
- Army cutworm
- Brown wheat mite
- Corn leaf aphid
- Oat aphid
- Fall armyworm
- Winter grain mite
- False wireworm
- Greenbug
- Russian wheat aphid
- Spider mite

STORED GRAINS

- Rice weevil
- Granary weevil
- Lesser grain borer

☑ **NOTE:** The above are considered primary insects and they develop inside the kernel.

- Indian meal moth
- Rusty grain beetle

- Flour beetles
- Saw-toothed grain beetle

☑ **NOTE:** The above are considered secondary insects and feed on the cracked kernels.

SORGHUM

- Chinch bug
- Corn earworms
- Corn leaf aphid
- Fall armyworm
- False chinch bug
- Grasshoppers
- Lesser cornstalk borer
- Mites
- Sorghum greenbug
- Sorghum midge
- Sorghum webworm
- Southwestern corn borer
- White grubs
- Wireworm
- Seedcorn beetle

SOYBEANS

- Bean leaf beetle

  ☑ **NOTE:** Adult bean leaf beetles eat round holes in leaves and feed on small pods; during the larval stage the bean leaf beetle feeds on roots.

- Mites
- Blister beetle
- Loopers
- Green cloverworm
- Stink bugs

  ☑ **NOTE:** Stink bugs suck sap from bean pods; the insertion of digestive juices into the bean causes deterioration of the plant.

- Corn earworm
- Velvetbean caterpillar

  ☑ **NOTE:** The larvae of velvetbean caterpillar eat the leaves, buds, and stems of the plant.

- Cutworms
- Fall armyworm
- Garden webworm
- Grasshopper
- Lesser cornstalk borer

  ☑ **NOTE:** The lesser cornstalk borer girdles the stems and roots of plants.

- Seed corn maggot or wireworm
- Three-cornered alfalfa hopper

☑ **NOTE:** The three-cornered alfalfa hopper feed on stems and may girdle the stems at or above the soil level.

- Yellow-striped armyworm

OBJECTIVE 6

Complete Assignment Sheet 1.

OBJECTIVE 7

State ways weeds hinder crop production.

Optional Activities/
Resources in
Instructor's Guide

WORDS YOU SHOULD KNOW	
weed	any plant growing in an undesirable location

- Compete with crop for moisture
- Compete with crop for sunlight
- Compete with crop for soil nutrients
- Harbor insects and diseases
- Promote molding and spoilage in stored grains
- Reduce crop yield
- Reduce crop quality

☑ **NOTE:** Weed-infested crops can cause low-quality farm products. For example, weeds in livestock feed lower its quality and its market value, and weeds in feed eaten by dairy cows can affect the odor and taste of the dairy products made from their milk, thereby lowering their quality. In addition, some weeds are poisonous to livestock.

- Reduce crop value

☑ **NOTE:** One poor-quality, weed-infested crop will reduce profit by bringing a lower price, but profit is also reduced when time and money must be spent to control weeds to prevent a poor quality crop the following year.

OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

Identify weeds common to growing area.

WORDS YOU SHOULD KNOW	
annuals	plants that complete their life cycle in one year or less
biennials	plants that complete their life cycle in two years
summer annuals	plants that grow from seeds which sprout in the spring
perennials	plants that live three years or more and do not require reseeding or replanting
winter annuals	plants that grow from seeds which sprout in the fall

☑ **NOTE:** Crop producers should become familiar with weeds that are common to their area and with appropriate methods to control those weeds.

ANNUALS

- Annual bluegrass
- Barnyardgrass
- Black nightshade
- Chickweed
- Cheat
- Henbit
- Ragweed

  ☑ **NOTE:** Ragweed causes an allergic reaction in many people.

- Crabgrass

- Dodder

  ☑ **NOTE:** Dodder is a parasitic weed; it has no true leaves or roots and does not manufacture its own food. Dodder attaches itself to a host plant such as alfalfa or clover.

- Downy bromegrass
- Foxtail
- Lambsquarters
- Pepper grass
- Pigweed
- Purslane
- Shepherd's purse
- Wild mustard
- Wild oats

BIENNIALS

- Burdock
- Bull thistle
- Hound's tongue
- Mullein
- Poison hemlock
- Wild carrot
- Wild parsnip
- Yellow goatsbeard

PERENNIALS

- Austrian field cress
- Plantain
- Canada thistle
- Curled dock
- Dandelion
- Field bindweed
- Johnsongrass
- Leafy spurge
- Ox-eye daisy
- Sow thistle
- Quackgrass
- Sheep sorrel
- Snapdragon
- Wild garlic
- Wild onion

OBJECTIVE 9

Optional Activities/
Resources in
Instructor's Guide

Discuss bird and wildlife damage.

- Birds will eat some cereal seeds and can cause damage to young and mature crops of some plants. Generally, birds are more beneficial than harmful. Birds help control insects and some birds eat mice and other rodents.
- Rabbits eat many growing crops, particularly young cereals.

- Rodents eat or damage many growing crops.
    - Mice damage young plant seedlings and consume seeds.
    - Pocket gophers dig tunnels bringing the soil to the surface and eat the roots of plants.
    - Moles dig tunnels and eat parts of plants.
    - Prairie dogs eat plants and dig burrows.
    - Ground squirrels eat plants.
- Beavers gnaw and fell trees and in the process they dam drainages which can flood low lying areas and interfere with the watershed.

OBJECTIVE 10

Optional Activities/
Resources in
Instructor's Guide

Select from a list indications of plant diseases.

WORDS YOU SHOULD KNOW	
chlorosis	term that refers to changes in plant color, such as when green leaves lose their color or turn yellow
galls	swollen spots on the plant tissue
necrosis	death of plant tissue

- Changes in color
- Holes in leaves
- Wilting
- Necrosis
- Stunted growth
- Galls
- Shriveling and dying fruit
- Dropping leaves, blossoms, and fruits

- Malformations
- Rots
- Seepage

☑ **NOTE:** Diseases can affect any part of a plant including the roots, stems, leaves, flowers, or fruit at any stage in the plant's development. The symptoms of one disease affecting a plant are different than the symptoms of another disease. Crop producers must be familiar with the general indications of plant disease so that disease will be readily recognized and the plants can be treated promptly.

OBJECTIVE 11

Optional Activities/
Resources in
Instructor's Guide

Match causes of infectious plant diseases to their correct descriptions.

WORDS YOU SHOULD KNOW

insect vectors	insects that spread plant diseases from one plant to another plant

- **Fungi** – living plants that lack chlorophyll and must obtain their food from other living plants or decaying organic matter

  ☑ **NOTE:** Fungi are responsible for a great number and variety of plant diseases, and they can attack any part of a plant. Some diseases that are caused by fungi are stem rust in wheat, leaf blight in corn, smut diseases in grasses, and root and stem rot in soybeans. Most fungi produce spores that are spread by wind, water, or insects. Many fungi require moisture and moderate temperatures to grow, produce spores, and infect plants.

- **Bacteria** – microscopic, single-celled plants that are borne inside a seed or enter a plant through natural openings or injured tissue

  ☑ **NOTE:** Compared to the number of major diseases caused by fungi, the number of diseases caused by bacteria is small. Some bacterial diseases are wilt in alfalfa, wilt in tobacco, leaf blight in rice, and angular spot in cotton.

- **Viruses** – submicroscopic crystalline particles made up of nucleic acid and protein; multiply only inside living hosts

  ☑ **NOTE:** Few living organisms are immune from viruses. Plants can be attacked by one or more viruses at the same time. Diseases such as soybean mosaic, common mosaic in beans, dwarf maize mosaic, and streak and barley strip mosaic in small grains are caused by viruses. Viruses are often spread by insect vectors.

- **Mycoplasmas** – extremely small disease causing agents that live and multiply inside living cells of the host plant; they are devoid of cell walls

- **Nematodes** – slender, microscopic worms that usually live in the soil, but will attack small plant roots and kill the plant by feeding on its cells and by secreting toxic saliva

OBJECTIVE 12 **Complete Assignment Sheet 2.**

ASSIGNMENT SHEET 1

COMMON PESTS

D-3

Name ______________________________ Score __________

OBJECTIVE 6

Identify insect damage in common field crops.

EQUIPMENT AND SUPPLIES

- Various plants with insect damage

INSTRUCTIONS

Life Science
- Identify/classify living organisms

Cognitive Activities
- Analyze/synthesize information
- Draw conclusions

PART 1

Write the answers to the following questions in the blanks provided.

1. An alfalfa crop has plants that have small areas of discoloration, yellowing, dead leaves, and stunted growth. What causes this type of damage? What insect is possibly the cause?

2. A corn plant has leaves that are chewed on. What causes this type of damage? Name one insect that is the possible cause.

3. A soybean plant has girdled stems and roots. What type of damage is this?

4. Dieback of plant parts is often caused by what types of insects?

PART 2

Your instructor will show examples of insect damage to plants. Write the name of the plant and the type of damage in the blanks provided.

ASSIGNMENT SHEET 2

COMMON PESTS

D-3

Name ______________________ Score __________

OBJECTIVE 13

Identify diseases in common field crops.

EQUIPMENT AND SUPPLIES

- Various plants with disease damage
- Handout 1 *Plant Diseases*

INSTRUCTIONS

Life Science
- Identify/classify living organisms

Cognitive Activities
- Analyze/synthesize information
- Draw conclusions

PART 1

Using Handout 1, write the diseases in the blanks provided.

1. An alfalfa field has some plants which have light green to yellow blotches on the leaves. There is also a grayish cottony growth on the underside of the leaves and some leaves are twisted.

   ____

2. An alfalfa field has some plants which have small brown to black spots on the leaves.

   ____

3. A corn field has some plants which have light and dark green mottling.

   ____

4. A corn field has plants which have weakening and breakage of the stalk.

   ____

5. A cotton field has young seedlings that are dead.

   ____

6. A peanut crop has some plants which have brown to dark brown circular spots on the leaves surrounded by a yellow halo. The spots appear brown on the underside of the leaves.

   ____

7. A peanut crop has some plants which have the branches or entire plants yellowing and wilting; there are also light tan to pale white lesions on lower stems and diseased areas have white mold.

____

8. Barley plants have hard, black masses of smut covered with a grayish membrane in place of kernels.

____

9. A wheat field has some plants that have mottling, yellow-colored streaks along the veins and show stunted growth.

____

10. In a wheat field the base of wheat seedlings is discolored chocolate brown.

____

11. Hard black and purplish bodies have replaced the kernels in the heads of rye plants.

____

12. Sorghum seedling leaves have small reddish-purple spots.

____

13. Sorghum plants have a large smut gall at the head of the plant; the gall is surrounded by a thin, white membrane.

____

14. A soybean field has some plants that have white, powderlike patches of mold growth on stems, cotyledons, leaf surfaces, and pods.

____

15. Soybean plants have a pink to purple discoloration of parts of the seed coat.

____

PART 2

Your instructor will show several examples of plant diseases. Write the name of the plant, the symptoms, and the disease in the blanks provided.

OBJECTIVE SHEET

CONTROLLING PESTS

D-4

INTRODUCTION

Controlling pests is a major concern for crop producers. Pest damage to crops can lower the quantity and quality of yield and severe pest damage may destroy the entire crop. There are various methods available to the crop producer to help control plant pests including both chemical and natural methods. To have an effective pest management program, the producer must have an understanding of the control methods available, the types of pesticides available, and how to correctly apply pesticides. **Any person applying pesticides or operating equipment must be adequately trained and use appropriate protective clothing and equipment.**

PREREQUISITES

Soil, Plant, and Crop Science Unit A-2 "Safety" and Unit D-3 "Common Pests"

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS

PREREADING:	Read *Weed Control in Agronomic Crops*, OSU Extension Fact Sheet No. F-2751.
WRITING:	Write a short (one paragraph to one page) essay on weed control in agronomic crops. Include a discussion on why you believe the principles listed in the fact sheet are important.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment and Job Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. List methods of controlling plant pests.
2. Name categories of pesticides and the pests they are used on.
3. Discuss the chemical classifications of pesticides.
4. Explain the principles of integrated pest management.
5. Match methods of applying pesticides to their definitions.
6. List factors to consider when choosing a herbicide.
7. List factors which determine the effectiveness of a pesticide.
8. Describe various biological and cultural control methods.
9. Select appropriate methods of pest control. (Assignment Sheet 1)
10. Interpret information on a pesticide label. (Assignment Sheet 2)
11. Select appropriate pesticide category. (Assignment Sheet 3)
12. Determine application rates. (Assignment Sheet 4)
13. Calculate pesticide costs. (Assignment Sheet 5)
14. Calibrate a sprayer. (Job Sheet 1)
15. Apply pesticide. (Job Sheet 2)
16. Clean pesticide equipment. (Job Sheet 3)
17. Dispose of chemical containers. (Job Sheet 4)

INFORMATION SHEET

CONTROLLING PESTS

D-4

OBJECTIVE 1

Optional Activities/ Resources in Instructor's Guide

List methods of controlling plant pests.

WORDS YOU SHOULD KNOW	
pesticide	a chemical that kills undesirable organisms such as insects, fungus, and weeds

- Resistant varieties of plants

  ☑ **NOTE:** The development of resistant varieties of crops is ongoing. New varieties are constantly being introduced to better resist pests. Host resistance is effective because the host plant is more tolerant than other varieties and is not as likely to be severely damaged by pests. Chemicals in the host may also prevent the pest from achieving a complete life cycle.

- Biological control

  EXAMPLE: The use of predatory mites to control spider mites.

- Cultural control

  EXAMPLE: Crop rotation

- Mechanical control

  EXAMPLES: Traps, barriers, electricity, lights

- Sanitation

  EXAMPLES: Using pest-free seeds, decontaminating equipment

- Chemical control

  EXAMPLE: Pesticides

OBJECTIVE 2

Required Activities/
Resources
- Discussion

Optional Activities/
Resources in
Instructor's Guide

Name categories of pesticides and the pests they are used on.

Discuss "general use" and "restricted use" classifications of pesticides.

- **insecticides** – control insects
- **fungicides** – control fungus diseases
- **herbicides** – control weeds
- **nematicides** – control nematodes
- **rodenticides** – control rodents such as rats and mice
- **acaricides** – control mites

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

Discuss the chemical classifications of pesticides.

WORDS YOU SHOULD KNOW	
adjuvant	a substance added to the pesticide spray mixture to aid or improve the performance of the main ingredient
contacts	pesticides that kill pests by contact
fumigants	gases that kill pests when they are inhaled or absorbed by the pest
non-selective	pesticides that kill a wide variety of pests but may also be harmful to desirable organisms
protectants	pesticides that are applied to prevent entry or damage by pests
selective	pesticides that control some specific pests without destroying a crop or other desirable species
sterilants	pesticides that make pests unable to reproduce
stomach poisons	pesticides that kill pests when they are swallowed
systemics	pesticides that enter the plant through the roots or leaves and are translocated within the plant vascular system; systemics kill the pest but do not harm the host plant
translocation	the movement of chemical substances within a plant

- **inorganic pesticides** – pesticides that are made from minerals; minerals that are commonly used are arsenic, copper, boron, lead, mercury, sulfur, tin, and zinc.

  EXAMPLE: Zinc phosphide

- **synthetic organic pesticides** – pesticides that are man-made; these pesticides contain carbon, hydrogen, and one or more elements such as chlorine, phosphorous, and nitrogen.

  EXAMPLE: Parathion

- **living micro-organisms** – viruses, bacteria, and fungi which are cultured in a laboratory

- **plant-derived organic pesticides** – pesticides made from plants or plant parts

  EXAMPLE: Pyrethins

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Explain the principles of integrated pest management.

WORDS YOU SHOULD KNOW	
ecosystem	a community composed of plants and animals and the environment surrounding them

- Integrated pest management (IPM) incorporates all aspects of the crop and pest ecosystem to achieve the best possible system of crop management.

- Integrated pest management focuses on improved decision making through increased information. A variety of control methods can be used with less effort if crop producers have a better understanding of the ecological aspects of the system.

- The use of pesticides is balanced by management strategies such as resistant varieties of plants, biological controls, and cultural controls.

- Benefits of an integrated pest management system include:
  - ☐ increased yields through improved crop management practices
  - ☐ decrease in production costs through using other pest management strategies
  - ☐ decrease in the chance of the potential development of pesticide resistant strains and development of secondary pests

☐ decrease in the possibility of environmental contamination because of the informed use of pesticides

☐ conservation of energy when natural controls are used and chemical control is reduced

OBJECTIVE 5

Required Activities/
Resources
- Discussion

Optional Activities/
Resources in
Instructor's Guide

Match methods of applying pesticides to their definitions.

Discuss the various equipment used to apply both liquid and dry chemicals and the types of formulations available.

- **band** – application to a narrow strip along a crop row
- **basal** – application around the lower portion of the stems of woody plants
- **broadcast** – application that is uniform and applied over a broad area
- **directed** – application aimed at a specific target area, such as a portion of the plant
- **drench** – saturation of the soil with a pesticide
- **foliar** – application to the leaves of the plant
- **in-furrow** – application in the furrow in which the plant is growing
- **over-the-top** – application over the top of the crop
- **sidedress** – application along the side of a crop row
- **soil application** – application to the soil
- **soil incorporation** – application by the use of tillage implements which mix the pesticide and the soil
- **soil injection** – application beneath the soil surface
- **spot treatment** – application to a limited area

OBJECTIVE 6

Optional Activities/
Resources in
Instructor's Guide

List factors to consider when choosing a herbicide.

WORDS YOU SHOULD KNOW	
phytotoxic	injurious to plants

- Effectiveness and safety to the crop
- Herbicide must be registered for the intended use

  ☑ **NOTE:** Any application of herbicides must follow the use requirements. It is illegal to use herbicides in a manner which is not consistent with the use requirements.

- Availability
- Cost
- Application method
- Environmental concerns

  EXAMPLES: Nearby people and livestock, streams, lakes, possible drift of the herbicide

- Toxicity

  ☑ **NOTE:** Herbicides are toxic chemicals. When selecting a herbicide consider the risk to the user, nearby animals, and people.

- Soil type

  ☑ **NOTE:** Soil herbicides should be safe and effective on the type of soil they are applied to.

- Subsequent operations in the field

  ☑ **NOTE:** Crop producers should determine if toxic residues may remain which could affect future activities or crop production.

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

List factors which determine the effectiveness of a pesticide.

- Plant factors

  EXAMPLES: Size of the plants, seedling depth of the crop

- Application of the pesticide

  ☑ **NOTE:** Proper application of pesticides is extremely important. Pesticides must be used at the right time, in the right amount, and applied in the correct manner.

- Rainfall

  ☑ **NOTE:** Rainfall is an important consideration in the application of many pesticides. Too much rainfall can wash away or dilute the pesticide.

- Temperature
- Wind
- Soil texture and organic matter

  ☑ **NOTE:** Permeability affects the movement of the chemical in the soil.

OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

Describe various biological and cultural control methods.

- **Biological control**
  - ☐ Predators and parasites – Organisms which attack insect pests in their native environment, are imported or produced in laboratories, and are then released in infested areas.
  - ☐ Pathogens – Parasitic bacteria, viruses, and fungi are introduced into infested crops and control insects by introducing diseases. The disease agents may be naturally occurring. They also may be imported or produced in laboratories.

    EXAMPLE: The use of pathogens to control the Japanese beetle

- Release of sterile males – The males of some insect species are reared and sterilized in laboratories. The sterile males are released into infested crops to mate with the females which produce infertile eggs or sterile offspring and reduce the pest population.

  EXAMPLE: Release of sterile male screw worms which attack cattle

- Pheromones – An insect pheromone is identified and synthetically produced and then used to disrupt the behavior of a particular insect. Pheromones may be used to alter reproductive patterns or attract insects into a trap.

  ☑ **NOTE:** Because pheromones affect only one specific group of insects, their use does not present a danger to other species. However, there have been few pheromones discovered and produced synthetically and their use is still considered experimental. It is also expensive to develop pheromones.

- Juvenile hormones – Hormones which are species-specific chemicals that interrupt the metamorphosis of insects and prevent reproduction by preventing immature insects from maturing.

  ☑ **NOTE:** The use of juvenile hormones is still being developed. Juvenile hormones have the same benefits and drawbacks as pheromones.

- **Cultural controls**

  - Crop rotation – Crop rotation includes taking infested fields out of production and either leaving them fallow or planting a different crop. These practices may deprive pests of host plants on which they feed and reproduce.

    ☑ **NOTE:** Crop rotation is most effective against insects which have a long life cycle and attack the crop at all stages of growth. Traditional crop rotations were often developed to help reduce pest problems.

  - Trap crops – Crops which attract pests are planted early or nearby to attract pests away from the main crop. The trap crop is destroyed at a time that will break the reproductive cycle of the pest.

☐ Delay of planting – Delaying planting of crops may reduce the pest population by depriving the pest of the host plant needed for food and reproduction when the pest population is most abundant.

EXAMPLE: Hessian Fly damage in wheat can be prevented if planting is delayed until fly reproduction has ceased for the year.

☐ Harvest timing – Crops should be harvested as soon as they are mature especially if they are susceptible to pest damage.

EXAMPLE: Wireworm damage to mature potatoes decreases quality and is very damaging if the crop is left in the ground even for a brief time after maturity.

OBJECTIVE 9	**Complete Assignment Sheet 1.**
OBJECTIVE 10	**Complete Assignment Sheet 2.**
OBJECTIVE 11	**Complete Assignment Sheet 3.**
OBJECTIVE 12	**Complete Assignment Sheet 4.**
OBJECTIVE 13	**Complete Assignment Sheet 5.**
OBJECTIVE 14	**Complete Job Sheet 1.**
OBJECTIVE 15	**Complete Job Sheet 2.**
OBJECTIVE 16	**Complete Job Sheet 3.**
OBJECTIVE 17	**Complete Job Sheet 4.**

ASSIGNMENT SHEET 1 — CONTROLLING PESTS

D-4

Name ______________________ Score __________

OBJECTIVE 9

Select appropriate methods of pest control.

EQUIPMENT AND SUPPLIES

- *Insects on Small Grains and Their Control*, OSU Extension Fact Sheet No. 7176

INSTRUCTIONS

Reading Comprehension
- Gain factual information

Cognitive Activities
- Analyze/synthesize information
- Draw conclusions

Read *Insects on Small Grains and Their Control* and then answer the following questions.

1. A wheat crop has greenbug infestation. What biological control may be used? When should chemical controls be used?

2. A crop producer is planning on planting barley. There has been a problem with greenbugs in the past. Is there a resistant variety of barley the producer could plant?

3. A crop producer is planning on planting wheat and is concerned about Hessian Fly damage. What can the producer do?

4. A crop producer has noticed a small number of winter grain mites on a crop. Does the producer need to take immediate control actions? Why or why not?

____

____

____

____

5. A crop producer is concerned about white grubs. What should the control include?

____

____

____

6. Adequate control of false wireworms can be achieved by taking what measures?

____

____

7. Should a crop producer always use chemical controls for every pest problem? Why or why not?

____

____

____

____

847

ASSIGNMENT SHEET 2

CONTROLLING PESTS

D-4

Name ______________________ Score ________

OBJECTIVE 10 **Interpret information on a pesticide label.**

EQUIPMENT AND SUPPLIES

- Current pesticide labels
- Handout 1 *Reading a Pesticide Label*

INSTRUCTIONS

Your instructor will give you an example of a pesticide label. Answer the following questions about the pesticide label.

Reading Comprehension
- Gain factual information
- Draw conclusions

Functional Reading
- Use content area vocabulary

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

1. What is the use classification of the pesticide? What does this mean?

2. What hazards does the chemical present to humans, animals, and the environment?

3. What is the trade name of the pesticide?

4. What should you do in case of overexposure or poisoning for this pesticide?

5. What is the signal word on the pesticide label?

6. What pests does this pesticide control?

7. What form should the pesticide be used in?

8. What equipment is needed to apply the pesticide?

9. What crop is the pesticide to be used on?

10. What are the mixing directions and how much pesticide should be used?

ASSIGNMENT SHEET 3

CONTROLLING PESTS

D-4

Name ______________________________ Score __________

OBJECTIVE 11 **Select appropriate pesticide category.**

INSTRUCTIONS

Read the following questions and then write the pesticide that would be used in the blanks provided. For example, if the problem was grasshoppers, an insecticide would be used.

Cognitive Activities
- Draw conclusions

1. An alfalfa field is infested with alfalfa weevils.

   ____

2. A pasture has field bindweed.

   ____

3. Alfalfa plants have dodder.

   ____

4. A soybean crop has some plants which have anthracnose.

   ____

5. A wheat crop has powdery mildew.

   ____

6. A cotton field has plants which have galls or swollen areas on feeder roots.

   ____

7. A soybean field has Johnsongrass.

   ____

8. A corn crop has seedling blight.

____

9. A peanut crop has spider mites.

____

10. A cotton crop has loopers.

____

ASSIGNMENT SHEET 4

CONTROLLING PESTS

D-4

Name ______________________________ Score __________

OBJECTIVE 12 **Determine application rates.**

INTRODUCTION There are two calibration methods for use with broadcast and band treatments: the row or band method and the tank volume method. The steps for the tank volume method are given below.

1. Measure off one-eighth of a mile in the area to be treated.
2. With the tank full of water, spray the test area using the spray pressure and tractor speed to be used in the actual spraying. Note the throttle and gear setting used in the test run.
3. Refill the tank and measure the amount of water required for refill.
4. Repeat the test run.
5. Average the two passes to determine "gallons used."
6. For broadcast application use the following formula:

   $$\text{GPA (Gallons per acre)} = \frac{\text{Gallons Used x 66}}{\text{Feet of Spray Swath Width}}$$

   For band applications used the following formula:

   $$\text{GPA} = \frac{\text{Gallons used x 792}}{\text{Band Width (inches) x No. of Bands}}$$

7. Divide the capacity of the tank by the GPA. This will give you the number of acres per tank.
8. Multiply the recommended chemical rate per acre by the number of acres per tank. This will give you the amount of chemical to add to the tank.

INSTRUCTIONS

Functional Math
- Solve practical problems

Calculate the application rates for the following problem (tank volume method).

After making two test runs you determine that it takes 60 gallons of water to refill the tank after the first test application and 55 gallons after the second test application. For your calculations assume you are using a broadcast sprayer with a 20 foot swath or the band application sprayer with 12, 12 inch bands.

ASSIGNMENT SHEET 5

CONTROLLING PESTS

D-4

Name ______________________ Score __________

OBJECTIVE 13 **Calculate pesticide costs.**

EQUIPMENT AND SUPPLIES

- Pesticide labels and current prices

INSTRUCTIONS

Reading Comprehension
- Gain factual information

Functional Math
- Solve practical problems

Your instructor will give you pesticide labels and the current cost of the pesticide. Your instructor will also tell you the crop and the area to be treated. To find the cost of the pesticide you will need to determine gallons per acre for application. Follow the steps below:

1. Determine acres in the area to be treated.
2. Obtain gallons per acre for application from the manufacturer's recommendations.
3. Multiply the amount of pesticide recommended per acre by the size of the acreage to be treated.
4. Multiply the required gallons of pesticide by the cost per gallon.

☑ **NOTE:** Producers must also consider indirect costs of pesticide application such as equipment wear and the work time it takes to apply the pesticide.

JOB
SHEET 1

CONTROLLING PESTS

D-4

Name ______________________________

OBJECTIVE 14 **Calibrate a sprayer.**

EQUIPMENT AND SUPPLIES

- Field sprayer
- Stopwatch
- Measuring bottle
- Appropriate protective clothing and equipment

PROCEDURE

Reading Comprehension
- Gain factual information

Functional Reading
- Follow written instructions

Functional Math
- Solve practical problems

Job Acquisition/ Development
- Master specific job task/procedure

	Yes	No
1. Perform precalibration checks by servicing the entire sprayer and checking for uniform nozzle output and pattern.	____	____

☑ **NOTE: Always follow manufacturer recommendations and safety precautions.** Servicing includes cleaning all lines and strainers and making certain they are the correct size; inspecting all hoses and hose clamps for damage; and checking the pressure gauges. To determine if nozzles flow evenly, catch a timed sample from each nozzle. Nozzles that vary more than plus or minus 5% from the average output should be replaced. To check the spraying pattern, spray water on a warm dry paved road or lot and observe the drying pattern. If some strips dry faster or slower than others, the pattern is not uniform.

Yes No

2. Determine if the sprayer is applying the proper GPA of the chemical. To check this use the nozzle output method, which is used with the sprayer stationary. To determine this the sprayer output in GPM, ground speed (MPH), and spray width per nozzle must be determined using the following steps:

   a. Operate the sprayer with water at the correct pressure. Using a measuring bottle, collect the output of each nozzle for one minute. Determine the average number of ounces per minute (OPM) of output for each nozzle. ____ ____

   b. Compute the GPM/nozzle using the following formula: ____ ____

$$GPM = \frac{OPM}{128\ oz/gal}$$

   c. Select the ground speed at which the sprayer will be operated. ____ ____

   ☑ **NOTE:** Ground speed is generally 3-8 MPH.

   d. Determine the spray width per nozzle (W) in inches. ____ ____

   ☑ **NOTE:** For broadcast spraying W is the distance between nozzles and for band spraying W is the row spacing or band width divided by the number of nozzles per row or band.

   e. Determine the sprayer's output in gallons per acre (GPA) using the following formula: ____ ____

$$GPA = \frac{GPM \times 5940}{MPH \times W}$$

	Yes	No
3. If step 2 did not give you the desired application rate, one or more factors must be changed. Minor changes can be made by increasing or decreasing nozzle pressure and larger changes can be made by changing ground speed or the size of the nozzle tips.	____	____
4. Properly clean and store all equipment.	____	____

SKILL TEST RECORD

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Safety followed	4	3	2	1
Precalibration checks performed	4	3	2	1
Properly calibrated sprayer	4	3	2	1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

4 **Skilled** – Can perform job with no additional training.
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
1 **Unskilled** – Is familiar with process, but is unable to perform job.

EVALUATOR'S COMMENTS

____

____

____

JOB SHEET 2

CONTROLLING PESTS

D-4

Name ______________________________

OBJECTIVE 15 **Apply pesticide.**

EQUIPMENT AND SUPPLIES

- Pesticide to be applied
- Application equipment
- Protective clothing and equipment
- Field or plants to be treated

⚠ **WARNING:** Death or serious injury from pesticides possible. Follow all safety precautions and manufacturer recommendations.

PROCEDURE

Reading Comprehension
- Gain factual information

Functional Reading
- Follow written instructions

Functional Math
- Solve practical problems

Job Acquisition/ Development
- Master specific job task/procedure

	Yes	No
1. Determine appropriate pesticide to be used.	____	____
2. Carefully read and understand all label instructions and precautions.	____	____
3. Determine the appropriate application for given crop, area, and pesticide. EXAMPLES: Band, basal, broadcast	____	____
4. Determine the manufacturer recommended application and obtain the proper amount of pesticide for the area to be treated.	____	____
5. Put on all required protective clothing and equipment.	____	____
6. Gather the necessary equipment and supplies.	____	____

	Yes	No
7. Mix the pesticide, if applicable.	____	____
8. Perform precalibration checks.	____	____
9. Determine the application rate of the equipment (calibrate sprayer).	____	____
10. Follow all safety standards and manufacturer's recommendations.	____	____
11. Apply pesticide to the crop.	____	____
12. Clean up. (See Job Sheet 3)	____	____

SKILL TEST RECORD

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Safety followed	4	3	2	1
Followed manufacturer's instructions	4	3	2	1
Applied pesticide correctly	4	3	2	1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

4 **Skilled** – Can perform job with no additional training.
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
1 **Unskilled** – Is familiar with process, but is unable to perform job.

EVALUATOR'S COMMENTS

____

____

____

JOB
SHEET 3

CONTROLLING PESTS

D-4

Name ______________________________

OBJECTIVE 16 **Clean pesticide equipment.**

EQUIPMENT AND SUPPLIES

- Sprayer
- Water
- Biodegradable household detergent
- Household ammonia
- Wooden toothpick or toothbrush
- Appropriate protective clothing and equipment

PROCEDURE

Functional Reading
- Follow written instructions

Job Acquisition/ Development
- Master specific job task/procedure

	Yes	No
1. Wear proper protective equipment.	____	____
2. Thoroughly flush the sprayer with water inside and out.	____	____
☑ **NOTE:** Residues of oil-based herbicides, such as esters of 2-4 D, should be removed by rinsing the sprayer with one gallon of kerosene or diesel fuel (not gasoline) to 25 gallons of water. Consult pesticide manuals for specific instructions on cleaning equipment for oil-based herbicides.		
3. Make sure that rinse water is contained and will not contaminate water or be accessible to humans or animals.	____	____
4. Check and clean suction, line, and nozzle strainers. Clogged nozzles should be cleaned with a wooden toothpick or toothbrush. Do not clean with metal objects since they may damage the orifice.	____	____
☑ **NOTE:** Rubber gloves must be used.		
5. Fill the tank one-half full with water and add one pound of biodegradable household detergent for every 50 gallons of water.	____	____

	Yes	No
6. Circulate the detergent solution and flush it out through the boom.		
7. Fill the tank 1/4 to 1/2 full of a water-ammonia solution, one quart of household ammonia to 25 gallons of water.		
8. Circulate the solution through the sprayer and pump a small amount of spray out through the nozzles.		
9. Let the remaining solution stand at least 6 hours and then pump it out through the nozzles.		
10. Remove the nozzles and strainers. Flush the sprayer twice with clean water.		
☑ **NOTE:** Rinse water may be disposed of by spraying on a field that is cleared for that specific pesticide.		
11. Store the sprayer in a dry building.		
☑ **NOTE:** If storing the sprayer for a period of time, antifreeze or rust inhibitor added to a small amount of water and pumped through the sprayer will help prevent rust and corrosion.		

SKILL TEST RECORD

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Flushed and cleaned sprayer	4	3	2	1
Made sure water would not contaminate	4	3	2	1
Checked and cleaned strainers	4	3	2	1
Equipment properly stored	4	3	2	1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

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3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
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EVALUATOR'S COMMENTS

JOB
SHEET 4

CONTROLLING PESTS

D-4

Name ______________________________

OBJECTIVE 17

Dispose of chemical containers.

EQUIPMENT AND SUPPLIES

- Pesticide labels (liquid pesticides)
- Containers for disposal (metal, plastic, or glass)
- Pesticide tank

PROCEDURE

Reading Comprehension
- Gain factual information

Functional Reading
- Follow written instructions

Job Acquisition/ Development
- Master specific job task/procedure

	Yes	No
1. Read the pesticide label for disposal information.	____	____
2. Triple rinse the container.	____	____
a. Empty the container in the tank and let it drain an additional 30 seconds.	____	____
b. Fill the container one-fifth to one-fourth with water.	____	____
c. Close the container and rotate the container so that the water reaches all inside parts of the container.	____	____
d. Drain the water into the tank and let it drain an additional 30 seconds.	____	____
e. Repeat steps b through d at least two more times (total of at least three rinses).	____	____
3. Properly dispose of the container by returning the container to the supplier (some large containers), taking the container to a recycling or disposal facility, or placing the container in a disposal site to be taken to a sanitary landfill.	____	____

SKILL TEST RECORD

EVALUATOR'S COMMENTS

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Read the label	4	3	2	1
Triple rinsed	4	3	2	1
Container properly disposed	4	3	2	1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

4 **Skilled** – Can perform job with no additional training.
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required.
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill.
1 **Unskilled** – Is familiar with process, but is unable to perform job.

EVALUATOR'S COMMENTS

OBJECTIVE SHEET

NATIVE AND IMPROVED PASTURES

D-5

INTRODUCTION

Native and improved pastures include a large amount of land in the United States. Native and improved pastures provide economical feed for livestock. Native pastures, sometimes referred to as native rangelands, consist of a wide variety of native plants, including grasses, forbs, shrubs, and trees. Rangelands also provide habitat for wildlife. Improved pastures consist of grasses which have been introduced. Proper management of native and improved pastures is essential for continued grazing benefits and also for conservation reasons.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS	
PREREADING:	Read *Differences Between Range and Introduced Pasture Management*, OSU Extension Facts No. 2867.
WRITING:	Write a short essay (one page) on the differences between range and introduced pasture management. Include a discussion of why you believe it is important to have both native and introduced pastures.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Select from a list factors affecting pasture management.
2. Name factors that affect forage growth.
3. List practices that improve grazing.
4. Define animal unit.
5. Match native grasses to their degree of palatability.
6. Complete a chart listing characteristics of native grasses.
7. List ways to prevent overgrazing.
8. Describe different grazing systems.
9. Match range sites to their descriptions.
10. Match degrees of pasture utilization to their description.
11. Select from a list advantages of improved pastures.
12. Complete a chart of important forage grasses.
13. Complete a chart of important forage legumes.
14. State the advantages of renovating pasture land.
15. Write six steps for renovating pasture land.
16. Identify collected rangeland plants. (Assignment Sheet 1)
17. Survey a native rangeland. (Assignment Sheet 2)
18. Survey a pasture to recommend improvement practices. (Assignment Sheet 3)
19. Calculate the cost of establishing an improved pasture management program. (Assignment Sheet 4)

NATIVE AND IMPROVED PASTURES D-5

OBJECTIVE 1

Optional Activities/
Resources in
Instructor's Guide

Select from a list factors affecting pasture management.

- Geographic region
- Soil
- Annual rainfall
- Crop adaptation
- Intended use of the pasture

OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

Name factors that affect forage growth.

- Rainfall
- Sunlight
- Temperature
- Nutrients in the soil
- Texture of the soil
- Structure of the soil
- Topography

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

List practices that improve grazing.

- Prescribed burning (controlled burning)

  ☑ **NOTE:** Prescribed burning should be done by knowledgeable individuals and only with advanced planning.

- Herbicides

870

- Mechanical treatments

  EXAMPLE: Aerating the soil

- Reseeding

- Fertilizing

- Erosion control

  EXAMPLE: Contour diversions constructed by bulldozers

- Water development

- Fencing

  EXAMPLE: Cell grazing

OBJECTIVE 4 **Define animal unit.**

Optional Activities/
Resources in
Instructor's Guide

WORDS YOU SHOULD KNOW	
animal unit months (AUM)	the amount of forage needed to support one animal unit for one month (30 days)
animal-unit equivalent (AUE)	a percentage of an animal unit which refers to the proportionate amount of forage needed; factors that determine AUE include animal species, stage of production, and body weight

Animal unit is one mature cow (1,000-pound or 454-kilogram) or its equivalent based upon demand for forage of 26 pounds (12 kilograms) of dry matter forage per day.

☑ **NOTE:** The purpose of defining an animal unit is to allow range managers to express the total forage demand in common units. The animal unit definition allows different types of livestock to be compared by using animal-unit equivalents. For example, sheep equal 0.2 animal units. This means that five sheep will consume approximately the same amount of forage as one cow.

OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Match native grasses to their degree of palatability.

WORDS YOU SHOULD KNOW	
climax	plant native to the area
decreaser	plant that decreases on a range when exposed to heavy grazing pressures
increaser	plant that increases on a range when decreasers are reduced
invader	plant which comes into a range after both increasers and decreasers have been reduced
palatable	pleasant to the animal's taste

- Very palatable
  - ☐ Big bluestem
  - ☐ Switchgrass
  - ☐ Indiangrass
  - ☐ Little bluestem

  ☑ **NOTE:** These four grasses make up what is known as the "big four" of the tall grass prairie.

- Palatable
  - ☐ Sideoats grama
  - ☐ Hairy grama
  - ☐ Blue grama
  - ☐ Buffalograss

- Less palatable
  - ☐ Broomsedge bluestem
  - ☐ Annual threeawn

☑ **NOTE:** In a climax change due to overgrazing, the tall grasses are first to leave, short grasses are second to leave, weeds are third to leave, and shrubs will be the last to leave range conditions.

Complete a chart listing characteristics of native grasses.

Grass	Type	Season	Description	Climax	Grazing Value
Little bluestem	Perennial	Warm	Bunchgrass; flat, bluish-colored basal shoots; folded leaf blades; seed stocks from 2 to 5 feet tall; important forage grass in Eastern Oklahoma (Osage Hills) and the Flint Hills of Kansas	Decreaser	Good
Big bluestem	Perennial	Warm	Tall grass; grows in large clumps; very leafy; seed stalks from 3 to 8 feet tall; seed head branches into three parts; lower leaves usually covered in silky hair; quality and quantity among the best of the prairie grasses; overuse and abuse has reduced amount of big bluestem	Decreaser	Excellent
Indiangrass	Perennial	Warm	Tall grass; golden plume-like seed heads 4-12 inches long, stems are 4-8 feet tall; claw-like ligule can be found where the leaf attaches to the sheath; very nutritious and palatable	Decreaser	Good
Switchgrass	Perennial	Warm	Tall grass; sod-forming; has large seed; stalks from 3-6 feet tall; green to bluish-green leaves; small nest of hair where the blade attaches to the sheath	Decreaser	Good
Sideoats grama	Perennial	Warm	Mid-grass; seed stalks 18-36 inches tall; small oatlike seeds hang down one side of the seed stem; flat leaf blades with hairs and bumps along the edges; nutritious; good for conservation	Increaser	Good

Grass	Type	Season	Description	Climax	Grazing Value
Hairy grama	Perennial	Warm	Short grass; 10-18 inches tall; tufted bunchgrass with slender stems; basal leaves are hairy on the edges and upper surface	Increaser	Fair
Blue grama	Perennial	Warm	Short grass; seed stalks are 10-20 inches tall; narrow leaves form a curly mass of bunchy sod	Increaser	Good
Buffalograss	Perennial	Warm	Short grass; sod-forming; usually no more than 5 inches tall; seed is produced in small hard burs; much of the plant will remain even with close grazing	Increaser	Good
Wildrye	Perennial	Cool	Several varieties; bunchgrass; 2-4 feet tall; palatable and nutritious	Decreaser	Good
Scribner panicum	Perennial	Cool	Forms small bunches 1-5 inches in diameter; seed stems are 8-15 inches tall; fine, short hairs on underside of the leaf blades; grows between bunches of taller grasses	Increaser	Fair
Prairie Threeawn	Annual	Warm	1-2 feet tall; smooth blades or with a few hairs; each seed has three awns, 1-2½ inches long, attached; unpalatable to livestock	Invader	Poor
Broomsedge bluestem	Perennial	Warm	Mid-tall bunchgrass, stems are 2-4 feet tall; straw-yellow color; unpalatable to livestock	Invader	Poor

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

List ways to prevent overgrazing.

WORDS YOU SHOULD KNOW

stocking rate	the number of livestock per acre

- Rotate grazing.
- Use appropriate stocking rates.
- Defer grazing during times of early growth and seed production periods.

☑ **NOTE:** Grazing too early in the spring can result in injury to young plants and does not give the plants an opportunity to recover from the winter season. Overgrazing or early pasturing can reduce the vigor of desirable plants and allow weeds to grow. Grazing too early may also cause destruction of plants by trampling because the ground is soft from winter freezing and thawing.

- Leave enough forage seed on the area to allow for reproduction needs of the forage.

☑ **NOTE:** The range management practice of "take half and leave half" can be used as a guideline for native pastures. If more than one-half of the forage is removed during a growing season, native plants should be given some degree of deferment during the same growing season. When more than one-half of the grass and legume tops are grazed, root growth is slowed; if 80 percent or more of the tops are grazed, the roots will stop growing for several days.

OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

Describe different grazing systems.

WORDS YOU SHOULD KNOW	
creep grazing	a system where calves are allowed access to certain areas from which cows are restricted
first and second grazers	a method of pasture management that involves two groups of livestock; first grazers are allowed first access to the pasture and second grazers are brought in after first grazers are removed; first grazers are generally livestock that have higher energy requirements
mixed grazing	grazing two or more classes of livestock on the same pasture; an example would be cattle and sheep
cell grazing	confining livestock to an area of forage to be consumed in a short period of time; this is a high management system of grazing

- **Continuous grazing** – grazing of a specific pasture throughout a season or a year
- **Rotational grazing** – system of heavy stocking followed by periods of no grazing so that the pasture forage is allowed to recover and grow again during the same season
- **Deferred grazing** – delaying the start of grazing to allow the pasture forage adequate time to provide for plant reproduction, establishment of new plants, or increased plant vigor
- **Stockpiling of forage** – accumulation of forage in the field during periods of good growth for use during periods of little or no growth

  ☑ **NOTE:** Stockpiling of forage is usually used under specific conditions. In regions that are subhumid and semiarid, grazing of tall grasses can be deferred until after frost and then grazed as standing dry "hay."

OBJECTIVE 9

Required Activities/
Resources
- Discussion

Optional Activities/
Resources in
Instructor's Guide

Match range sites to their description.

? Discuss rangeland areas of the United States.

- **Bottomland** – soil located along creeks and rivers; subject to overflow; very productive and capable of producing large amounts of forage plants such as little bluestem, big bluestem, switchgrass, and Indiangrass
- **Loamy or sandy prairie** – Loamy or sandy textured soil with good, deep subsoil which supports highly productive main grasses such as little bluestem, big bluestem, Indiangrass, switchgrass, sideoats grama, blue grama, and buffalograss
- **Savannah or rocky savannah** – vegetative area between forest and prairie grassland with some scattered trees and native grasses
- **Deep sand** – soil with coarse texture that takes water readily with woody shrubs and tall grasses
- **Hard land or claypan prairie** – soil with medium or fine textured top soil and moderate or deep subsoil; sites are nearly level to gently sloping upland
- **Very shallow or rocky** – soil less than 10 inches deep and very rocky and rough; production very low and will not stand heavy grazing
- **Steep slopes or ridges** – steep, rough, shallow land; very low production
- **Red clay prairie** – soil red in color with rolling and broken topography and some gentle slopes which support such grasses as buffalograss, blue grama, hairy grama, big bluestem, Indiangrass, little bluestem, and switchgrass
- **Rough broken or breaks** – range areas which are rough and broken by steep slopes, canyons, or gullies; not easily accessible to livestock

OBJECTIVE 10

Optional Activities/
Resources in
Instructor's Guide

Match degrees of pasture utilization to their description.

- **Ungrazed** – no livestock use
- **Light** – only the best plants are grazed
- **Moderate** – uniform grazing of the pasture (proper)
- **Close** – hedged appearance of shrubs and trampling damage
- **Severe** – overgrazed, only remnants of good plants are surviving

☑ **NOTE:** These definitions may vary according to differences among ecosystems and sites.

OBJECTIVE 11

Optional Activities/
Resources in
Instructor's Guide

Select from a list advantages of improved pastures.

- Increases carrying capacity of land

  ☑ **NOTE:** The cost of inputs such as fertilizer and herbicides to produce introduced pastures is higher. Inputs are not a cost effective practice on native pastures.

- Increases rate of gain
- Allows overseeding with legumes, which prolongs grazing season
- Can be used to complement native pastures in a rotational grazing system
- A combination of native and improved pastures allows greater flexibility in management and conservation of natural resources

  ☑ **NOTE:** Most wildlife are suited to native pastures. Diversification allows options such as leased hunting in combination with grazing.

Complete a chart of important forage grasses.

Grass	**Season**	**Description**	**Use**	**Soil Type**	**Areas Grown**
Bahiagrass	Warm	Coarse, numerous basal leaves flat or folded at the base with sparse hairs near the base; deep-rooted; forms a dense sod; once established few species are able to invade it	Pasture	Sandy soils near coastal areas	Florida; lower coastal plains of the southeastern United States
Bermudagrass	Warm	Small plants ranging from 6" - 24" in height; forms a sod; sensitive to frost	Pasture; hay; silage; lawns; general purpose; and erosion control	Well-drained fertile soils; responds well to nitrogen	Southern portions of the United States
Dallisgrass	Warm	Deep-rooted bunchgrass; 2-4 feet in height; slender, nearly leafless stems; forms a loose sod	Pasture	Bottom lands with high fertility	From New Jersey south to Tennessee and Florida, west to Texas and California
Johnsongrass	Warm	Persistent grass that grows from 3 - 6 feet tall; wide-leaves; considered a weed in some areas	Pasture, hay	Fine clay soils with high fertility and water-holding capacity	The Cotton Belt and southern portions of the Corn Belt
Kentucky bluegrass	Cool	Long, smooth, soft leaves; shallow root system; 1-2½ feet tall; forms a dense sod; not drought-resistant; blossoms once a year	Pasture grass, especially in horse production areas of Kentucky and Tennessee; lawn grass	Sandy loams to clays of high productivity	Northern two-thirds of the United States (does not grow well in arid regions)

Grass	Season	Description	Use	Soil Type	Areas Grown
Orchardgrass	Cool	Long, wide, V-shaped leaves; 2-4 feet tall; forms clumps or bunches	Used alone and in mixture with legumes for pasture, hay, and silage	Most soils except for sandy soils or poorly-drained soils	North central and northeastern United States; Northern Pacific Coast and Great Plains where there is adequate moisture
Perennial ryegrass	Cool	Slightly flattened stems; leaves are folded in the bud; reddish color at the base	Early pasture; lawns	Sandy loams to clays (medium to high fertility)	Southeastern United States and upper Pacific Coast
Redtop	Cool	Leaf blades are from 4 to 24 inches long and 1/4 " wide, smooth on the under surface, hairy on the upper surface; 3 feet tall; loose, pyramid shaped seed head; shallow vigorous root system that forms a loose, coarse turf	Used in pasture mixes; hay; soil conservation; suited to wetlands	Wide variety of soils including those that are wet; does well on acid soils	Throughout the United States except dry areas
Reed canarygrass	Cool	Long, broad, light green leaves; forms a dense sod; 4 - 6 feet tall; blooms once a year	Used for reducing soil erosion; pasture, hay, silage	Fertile, moist soils; also grows well on fertile, well-drained soils	North central and northeastern United States, humid Pacific Coast and Great Plains where there is adequate moisture

Grass	**Season**	**Description**	**Use**	**Soil Type**	**Areas Grown**
Smooth bromegrass	Cool	Long, narrow leaves; 2-4 feet tall; drought-resistant and temperature resistant; forms a heavy sod	Used alone and in mixture with legumes for hay, pasture, and silage	Wide variety of soils	Corn Belt and somewhat further north
Tall fescue	Cool	Deep-rooted; shiny, dark green leaves; 3 - 4 feet tall; bunch type grass; forms a tough sod	Pasture, winter pastures; hay; sometimes toxic because of a fungal mold	Wide variety of soils except coarse, sandy soils	Central and southeastern Unites States and humid Pacific Coast
Timothy	Cool	Shallow-rooted; long, narrow leaves and smooth stems; 24"-40" in height; bulb-like structures at the base function as food storage organs	Most widely used for hay; provides very palatable early pasture; silage; often mixed with legumes	Clay and clay loams; does poorly on sandy soils	Northeast, cool, humid climates; does poorly in hot, dry areas
Weeping Lovegrass	Warm	Narrow leaves; extensive, shallow root system; drought-resistant	Early pasture, soil conservation plantings	Wide variety of well-drained soils; prefers sandy loams	Southern Great Plains, southern half of Nevada and California east of the mountains

Grass	Season	Description	Use	Soil Type	Areas Grown
Wheatgrasses	Cool		Early-season forage, especially in the West; soil erosion control	Wide variety of soils except sands	Central and northern Great Plains; intermountain regions and higher altitudes of the mountains
Crested wheatgrass		Bunchgrass; 1-3 feet in height; dark green leaf blades; extensive root system; drought resistant			
Western wheatgrass		Bluish-colored stems; 1-3 feet in height; sod-forming			
Quackgrass		Thin, flat blades; vigorous straw-colored rhizomes may extend 3 to 8 feet horizontally; considered a noxious weed in many areas			
Old World Bluestems	Warm	Bunchgrass; mostly drought and cold tolerant, palatable to livestock; can withstand close grazing; are not closely related to native big and little bluestem	Forage, hay	Loam or clay-loam soils	Southern Great Plains
Plains Bluestem					
WW-Spar					
Caucasian					
Ganada					
King Ranch					
WW-Iron Master					

OBJECTIVE 13 | Complete a chart of important forage legumes.

Optional Activities/
Resources in
Instructor's Guide

Legume	Type	Description	Use	Soil Type	Areas Grown
Alfalfa	Perennial	There are several varieties of alfalfa; usually 24" to 36" in height; flower color varies with variety of alfalfa	Hay, pasture, and silage; for pasture may be mixed with smooth brome grass, timothy, orchardgrass, and tall fescue	Fertile soil with good surface and internal drainage; nonacid	A wide variety of regions where there is sufficient moisture
Alsike clover	Perennial	Smooth leaves and stem; continues to bloom and produce flowers over a long period; often will only survive for two years and is treated as a biennial	Hay, pasture, and silage; usually mixed	A wide variety of soils except sandy soils; will tolerate poor drainage and acid soils	Northwestern United States; north of Ohio and Potomac rivers, west to the Dakotas
Annual lespedeza	Annual	8-12 inches in height; reddish, much-branched stems	Pasture, hay; conservation practices; may be mixed with a companion crop such as oats; its low yield has contributed to a decrease in use	A wide variety of well-drained soils	Southern half of the United States; as far north as Iowa
Birdsfoot trefoil	Perennial	Growing plant resembles alfalfa; seeds are produced in long slender pods; drought resistant	Used for permanent pastures mixed with Kentucky bluegrass or other grass; hay	A wide variety of soil conditions; tolerant of acid soils	Northeastern quarter of the United States to eastern Kansas, Nebraska and the Dakotas; Pacific Northwest

Legume	Type	Description	Use	Soil Type	Areas Grown
Cicer milkvetch	Perennial	Pale yellow to white flowers; does not cause bloat; reproduces by underground stems	Pasture	A wide variety of soil condition; tolerates slight acidity to moderate alkalinity	Great Plains and western United States
Crimson clover	Annual	Crimson-colored flowers; may grow to a height of 1-3 feet	Winter pasture	A wide variety of soils including those that are fairly acid	Southeastern United States
Crownvetch	Perennial	Variegated white to purple flowers; spreads by creeping underground rootstocks	Erosion control; ground cover; soil improvement; pasture mixtures (its use for grazing is limited because it is unpalatable)	A wide variety of soils	Northern two-thirds of the United States
Hairy vetch	Annual	Purple flowers, nearly hairless; there are several cultivars of vetch	Early-season pasture and hay; soil improvement	Does well in both sandy and clay soils	Throughout the United States; most is grown in southern states for soil improvement during the winter

Legume	Type	Description	Use	Soil Type	Areas Grown
Red clover	Perennial	Red blossom; 18-30 inches in height; very leafy with fine stems; often treated as a biennial because of the disease anthracnose	Hay, pasture, soil improvement; often grown in combination with other crops; fits well into rotations	A wide variety of soils that are well-drained and non-acid	Northeastern quarter of the United States; eastern Dakotas, Nebraska, Kansas, Oklahoma, and Texas to Atlantic coast; Pacific northwest
Sainfoin	Perennial	Pink flowers; there are several cultivars; not as widely used as many other forage crops; does not cause bloat	Pasture, hay	Calcareous soils either dryland or irrigated	Northern Rocky Mountain states
Sericea lespedeza	Perennial	Leafy with coarse to fine stems; will grow to a height of 0.5-1 m; long, narrow leaflets; cream to purple flowers; new cultivars should result in greater use	Hay, pasture; soil conservation	Can grow on infertile or acid soils	Southern United States
Sweet clover	Biennial	Larger, white-flowered varieties may attain a height of 6 feet; yellow-flowered types generally do not grow as tall; care must be taken to avoid bloat; can withstand severe winters without being injured	Pasture, soil improvement; green manure crop	A wide variety of soil types; grows fairly well on less fertile soils or alkaline soils; cannot tolerate acid soil conditions	Central United States and areas of the Great Plains that have adequate rainfall

Legume	Type	Description	Use	Soil Type	Areas Grown
White clover/ Ladino clover	Perennial	White flowers; white clover is low growing generally 5-6 inches or less in height; ladino grows considerable taller; plants have the ability to form roots at every node resulting in new plants	Hay, pasture, silage (ladino); used in combination with other crops	A wide variety of soil types; prefers fertile, moist, well-drained soils	Throughout the United States; does best when cool, moist conditions prevail during the growing period
Arrowleaf clover	Annual	Large conical flower heads, initially white flowers that turn pink to purple; often exceed 5 cm; smooth, thick, hollow stems that are often purple, 60-150 cm in length; arrow-shaped leaflets have pronounced veins	Pasture	Well-drained sandy and clay soils; cannot tolerate high-lime soils or soils with poor drainage	Southeastern United States; from east Texas to South Carolina and southward from Oklahoma and Tennessee to the Gulf of Mexico

OBJECTIVE 14

Optional Activities/
Resources in
Instructor's Guide

State the advantages of renovating pasture land.

WORDS YOU SHOULD KNOW	
renovate	to restore or change the condition of something; to improve something, for example renovating pasture land

- Reduces competition of other plants
- Provides for more available nutrients
- Increases movement of air and water

OBJECTIVE 15

Optional Activities/
Resources in
Instructor's Guide

Write six steps for renovating pasture land.

1. Select the site to be renovated.

   ☑ **NOTE:** The selected site should have the best soil available. If possible, the site should be selected a year before the planned date of seeding.

2. Prepare the site to be renovated.

   EXAMPLES: Tillage, control noxious weeds such as Canada thistle and ironweed

3. Test the soil to determine nutrient deficiencies and then apply nutrients with timeliness and accuracy.
4. Choose the appropriate seeding mixture and plant at the correct time on a firm seedbed.
5. Use an integrated pest management system to control troublesome weeds, brush, and insects.
6. Manage the site by supplying adequate lime and fertilizers, monitoring grazing, and renovating when yields decrease substantially.

OBJECTIVE 16

Complete Assignment Sheet 1.

OBJECTIVE 17

Complete Assignment Sheet 2.

OBJECTIVE 18 **Complete Assignment Sheet 3.**

OBJECTIVE 19 **Complete Assignment Sheet 4.**

ASSIGNMENT SHEET 1

NATIVE AND IMPROVED PASTURES

D-5

Name ______________________________ Score __________

OBJECTIVE 16

Identify collected rangeland plants.

INSTRUCTIONS

Collect as many rangeland plants as possible, identify each plant, and complete the chart on the following page. Fill in the name of the plant, the type (annual, biennial, or perennial), season (warm or cool), whether the plant is native or introduced, climax (increaser, decreaser, or invader), and grazing value (good, fair, poor). Remember to get permission before entering property.

☑ **NOTE:** This Assignment Sheet is best done in early fall.

Life Science
- Identify/classify living organisms

Cognitive Activities
- Collect/record information
- Analyze/synthesize information

Plant	**Type**	**Season**	**Native or Introduced**	**Climax**	**Grazing Value**

ASSIGNMENT SHEET 2

NATIVE AND IMPROVED PASTURES

D-5

Name ______________________ Score __________

OBJECTIVE 17

Survey a native rangeland.

INSTRUCTIONS

Survey a native rangeland, determine the kind of site and degree of utilization, and indicate range condition. After determining the above factors, recommend control practices for improving the productivity of the range. Answer the following questions.

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

Life Science
- Identify/classify living organisms

Earth Science
- Investigate physical characteristics of the earth
- Investigate conservation of physical resources
- Investigate conservation of living resources
- Investigate issues of environmental impact

Cognitive Activities
- Collect/record information
- Analyze/synthesize information

1. Location of the range site.

____

____

2. What is the degree of utilization? If being used, what type of livestock?

____

3. Type of range site.

____

____

4. What type of plants are found on the site? Indicate the predominant decreaser, increaser, invader.

____

____

____

____

____

903

5. What is the topography of the land?

6. What is the average rainfall of the area?

7. What range management practices could be used to improve the productivity of the range? Examples might be decrease stocking rate, delay grazing, seed with adapted native grasses, control invading grasses by grazing intensively for short periods during growing season, or control weeds and brush.

ASSIGNMENT SHEET 3

NATIVE AND IMPROVED PASTURES

D-5

Name ______________________________ Score __________

OBJECTIVE 18

Survey a pasture to recommend improvement practices.

INSTRUCTIONS

Schedule a visit to a farm and survey the improved pasture. Answer the following questions based on your survey.

1. What is the location of the pasture? What is the approximate number of acres in the field?

   ____

   ____

   ____

2. What is the predominant vegetation?

   ____

3. What is the condition of the vegetation?

   ____

4. What type of livestock is utilizing the pasture?

   ____

5. What is the number of head per acre presently utilizing the field?

   ____

6. Is there an abundance of legumes present with the improved pasture grasses? If yes, what type of legume is present?

   ____

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

Life Science
- Identify/classify living organisms

Earth Science
- Investigate physical characteristics of the earth
- Investigate conservation of physical resources
- Investigate conservation of living resources
- Investigate issues of environmental impact

Cognitive Activities
- Collect/record information
- Analyze/synthesize information

7. Does the pasture show indications of weeds and brush being a problem?

8. Using the information collected above, recommend practices for improvement of forage production.

ASSIGNMENT SHEET 4

NATIVE AND IMPROVED PASTURES

D-5

Name ______________________________ Score __________

OBJECTIVE 19

Calculate the cost of establishing an improved pasture management program.

INSTRUCTIONS

Functional Math
- Solve practical problems

Suppose you were a farmer and wanted to convert 40 acres of native rangeland into some type of improved pasture program. Approximately 20 acres of the 40 acres are covered with cedar and blackjack. You will need to hire a bulldozer for 8 hours. The soil test information revealed that you would need to apply 200 lbs of 10-20-10 fertilizer and that you would need 2000 lbs of lime per acre. Using your local county Farm Service Agency programs, what would be the total cost of sprigging 40 acres of bermudagrass? (At this time you are not planning on overseeding.)

1. What will be the cost of removing the trees?

   ____

2. What will the fertilizer cost?

   ____

3. What will the sprigging cost?

   ____

4. What will the agricultural lime cost?

   ____

5. What will be the root plowing cost, if necessary?

   ____

6. What will be the cost of seedbed preparation?

   ____

7. What will be the total cost of sprigging the 40 acres?

____

8. What percent of the total cost will be paid by the county Farm Service Agency?

____

9. What will be the cost to you as a farmer?

____

10. What would be the carrying capacity of the improved pasture?

____

OBJECTIVE SHEET

HARVESTING

D-6

INTRODUCTION

Harvesting is one of the most important functions that a producer performs. Crops must be properly and efficiently harvested before they can be marketed. Harvesting must be performed at the time the crop is ready for harvest. The profit or loss that a producer realizes from a crop often depends on how efficiently or inefficiently that crop is harvested. Producers must be knowledgeable about all aspects of harvesting to ensure that their crops can be successfully harvested and then marketed.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS	
PREREADING:	Read *Combine Operation: Measuring Loss*, OSU Extension Facts No. 1225.
WRITING:	Write a short (one paragraph to one page) essay on why it is important for producers to minimize losses.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Explain the importance of harvesting efficiently.
2. Identify types of hand harvesting equipment.
3. Name types of power harvesting equipment.
4. Select from a list factors to consider when determining correct harvest times.
5. Match common field crops to their average harvesting rate.
6. Complete statements about harvesting specialty crops.
7. Survey harvesting methods for two crops in your region. (Assignment Sheet 1)
8. Determine costs of harvesting crops. (Assignment Sheet 2)
9. Determine correct harvest times. (Assignment Sheet 3)
10. Determine storage methods of harvested crops. (Assignment Sheet 4)

INFORMATION SHEET

HARVESTING

D-6

OBJECTIVE 1

Optional Activities/
Resources in
Instructor's Guide

Explain the importance of harvesting efficiently.

- Harvesting is one of the most important factors in profitable crop production. Crops must be harvested before the producer can market the crops.

- The percentage of crop lost in harvesting can directly affect the profit or loss the producer realizes from the crop.

    - ☐ Types of losses include:

        - ▸ Preharvest losses - losses which are generally weather related

          EXAMPLE: Wind or rain may shatter grain from the head.

        - ▸ Machine losses - losses caused by improperly adjusted equipment

          ☑ **NOTE:** Producers cannot do much to affect preharvest losses but they can lower machine losses.

- Crops that are harvested inefficiently or carelessly may result in a lower market value.

  EXAMPLE: Soybeans that contain splits, foreign matter, or excess moisture may be discounted.

OBJECTIVE 2

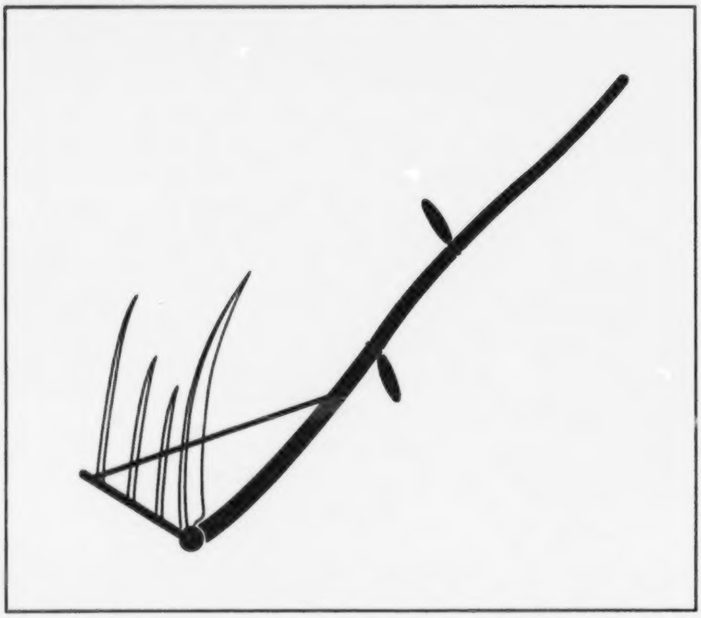
Optional Activities/ Resources in Instructor's Guide

Identify types of hand harvesting equipment.

☑ **NOTE:** Many people around the world still exist on grains which are harvested by hand.

- Scythes

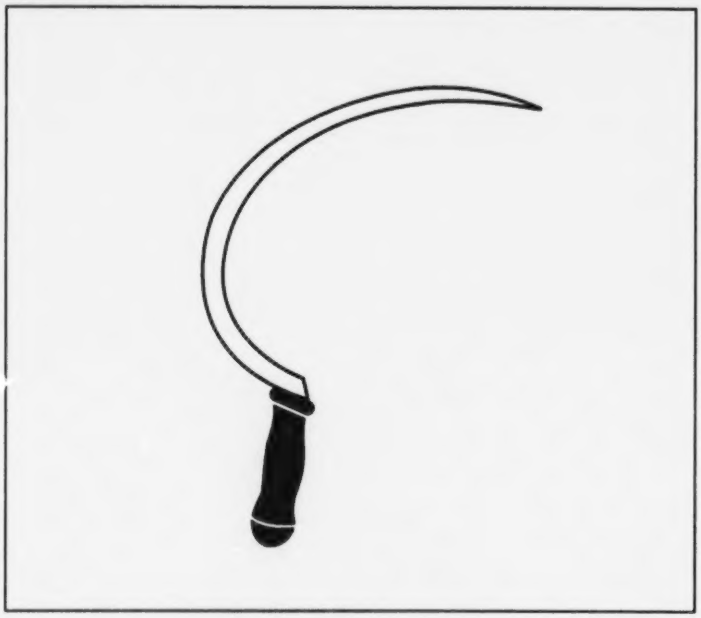
FIGURE 1



912

- Sickles

FIGURE 2



☑ **NOTE:** Other tools such as rakes may also be used to help in hand harvesting equipment.

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

Name types of power harvesting equipment.

- Balers

☑ **NOTE:** Balers are used for hay. They are classified according to power source, size of bale produced, twine-tie, and wire-tie.

☐ Small square baler

FIGURE 3

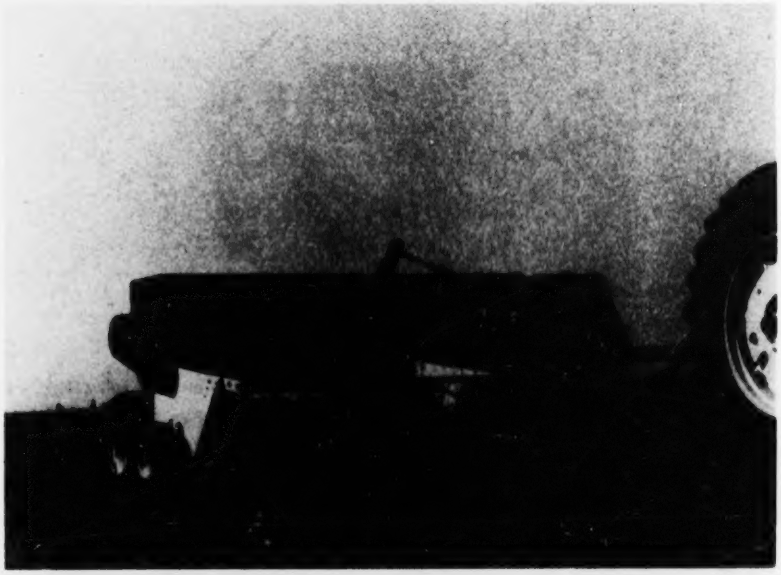


Photo courtesy of Deere and Company, Moline, Illinois.

☐ Large square baler

FIGURE 4

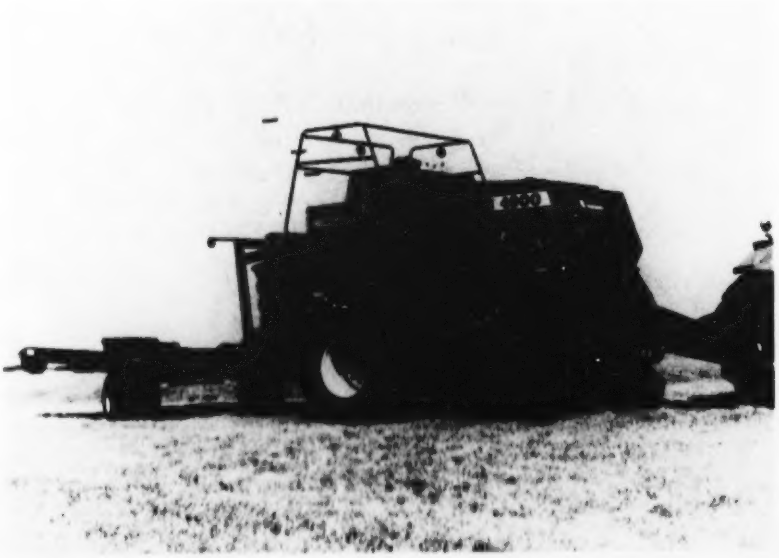


Photo courtesy of Heston.

☐ Round baler

FIGURE 5

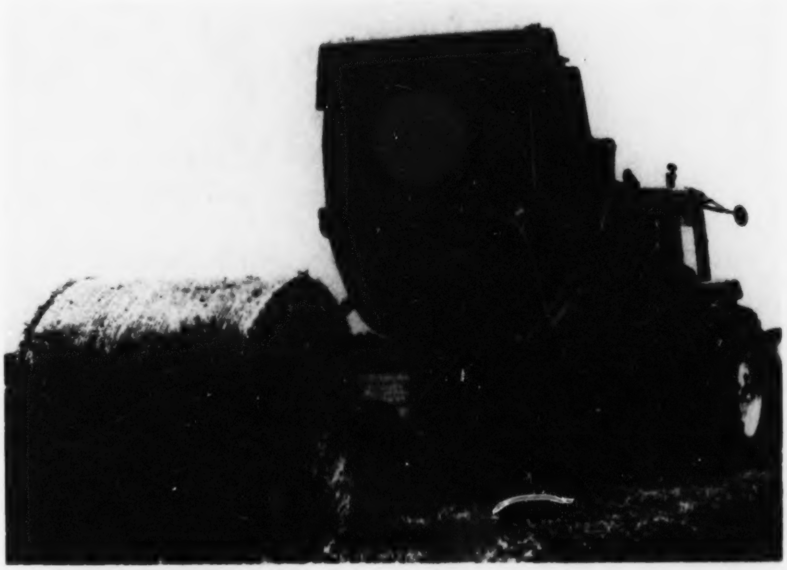


Photo courtesy of Deere and Company, Moline, Illinois.

- Forage harvester

  ☑ **NOTE:** Forage harvesters chop the forage. Chopped forage may be stored in upright, trench, or pit silos, or may be fed directly to livestock.

- Combine harvester

  ☑ **NOTE:** The combine harvester is used to harvest all types of grain and seed crops. Different attachments are added to combines to make them suitable for various crops. For example, a picker-sheller combine equipped with a corn head pick is used to harvest corn.

FIGURE 6

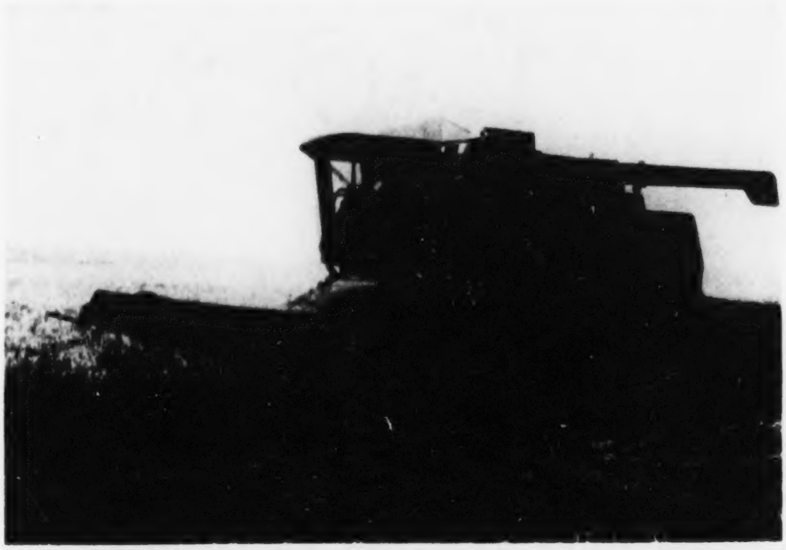


Photo courtesy of Deere and Company, Moline, Illinois.

- Cotton picker

- Cotton stripper

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Select from a list factors to consider when determining correct harvest times.

- Number of days from full bloom
- Stage of development of the plant

  EXAMPLES: Oats harvested for oat silage should be harvested while in the boot stage while the grain is still in the sheath; mungbeans should be harvested when one-half to two-thirds of the pods are mature.

- Moisture content

  EXAMPLE: The moisture content of barley should be 14 percent or less to ensure safe storage.

OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Match common field crops to their average harvesting rate.

☑ **NOTE:** Harvesting rates will vary according to region and factors such as weather. The figures below are average rates for the years 1989-1993 for Oklahoma crops.

- **Barley** – 39 bu/A
- **Corn for Grain** – 119 bu/A
- **Cotton Lint** – 343 lbs/A
- **Oats** – 37 bu/A
- **Peanuts** – 2274 lbs/A
- **Rye** – 20 bu/A
- **Soybeans** – 24 bu/A
- **Grain Sorghum** – 49 bu/A
- **Winter Wheat** – 29 bu/A
- **Alfalfa Hay** – 3.6 tons/A
- **Other Hay** – 1.7 tons/A

OBJECTIVE 6 **Complete statements about harvesting specialty crops.**

Optional Activities/ Resources in Instructor's Guide

WORDS YOU SHOULD KNOW	
specialty crop	a crop that is produced for a specific market; for example, Christmas trees or organically-grown vegetables

- Harvesting specialty crops can be management and labor intensive.
- Some specialty crops must be harvested frequently during the harvesting season.

  EXAMPLE: Okra plants must be harvested every other day.
- Specialty crops often have to be harvested by hand.

  EXAMPLE: Some specialty crops, such as chili peppers are often hand picked.
- Specialty crops often must be marketed immediately after harvesting for freshness or season.
- Specialty crops may require specialized equipment and/or storage facilities.

OBJECTIVE 7 **Complete Assignment Sheet 1.**

OBJECTIVE 8 **Complete Assignment Sheet 2.**

OBJECTIVE 9 **Complete Assignment Sheet 3.**

OBJECTIVE 10 **Complete Assignment Sheet 4.**

ASSIGNMENT SHEET 1

HARVESTING

D-6

Name ______________________________ Score __________

OBJECTIVE 7 **Survey harvesting methods for two crops in your region.**

INSTRUCTIONS Choose two crops that are grown in your region. Answer the questions below about harvesting the crops. You may need to interview local farmers, extension agents, equipment salespeople, or other individuals.

Research and Reference
- Select useful resources
- Locate resources

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Cognitive Activities
- Collect/record information

1. Name of the two crops.

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____

2. What equipment is needed to harvest the two crops?

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____

____

3. How does the producer determine when to harvest the two crops?

____

____

____

____

4. What is the average yield for the crops?

5. What special problems or concerns must be addressed by the farmer when harvesting the crops? (for example, hiring a custom combine crew)

6. Briefly describe the harvesting process for the two crops.

ASSIGNMENT SHEET 2 — HARVESTING — D-6

Name ______________________________ Score __________

OBJECTIVE 8

Determine costs of harvesting crops.

INSTRUCTIONS

Choose one crop that is grown in your local area or region. Using resource/reference books or publications, personal interviews, or other sources, determine the costs per acre of harvesting that crop. Write a short report on the costs including equipment costs, labor costs, and transportation costs. Refer to the OSU publication on custom rates.

Research and Reference
- Select useful resources
- Locate resources

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences
- Compose reports

Cognitive Activities
- Collect/record information

922

ASSIGNMENT SHEET 3

HARVESTING

D-6

Name ______________________________ Score __________

OBJECTIVE 9

Determine correct harvest times.

EQUIPMENT AND SUPPLIES

- Photographs of various crops in different developmental stages (with brief descriptions)
- Resource/reference books or publications on crop production

INSTRUCTIONS

Your instructor will show you photographs of various crops in different developmental stages. Using resource/reference books or publications on crop production, determine whether or not the crop is ready for harvest. Write a brief explanation of why or why not.

Life Science
- Identify/classify living organisms

Cognitive Activities
- Analyze/synthesize information
- Draw conclusions

1. Name of the crop ______________________________

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2. Name of the crop ______________________________

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3. Name of the crop ______________________

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4. Name of the crop ______________________

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5. Name of the crop ______________________

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ASSIGNMENT SHEET 4

HARVESTING

D-6

Name ______________________ Score __________

OBJECTIVE 10

Determine storage methods of harvested crops.

INTRODUCTION

Harvested crops must be properly stored to ensure the crop remains in acceptable condition. Factors such as moisture content of the crop, temperature, and pests must be considered when storing crops. Postharvest losses can be significant if crops are not properly stored.

INSTRUCTIONS

Choose two crops which are grown in your local area or region. Using resource/reference books and publications, personal interviews, or other sources determine the storage methods of the crops. In the blanks provided, discuss the storage methods for the two crops.

Research and Reference
- Select useful resources
- Locate resources

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences
- Compose reports

Cognitive Activities
- Collect/record information

OBJECTIVE SHEET

MARKETING CROPS AND GRADES

E-1

INTRODUCTION

If you become a farmer, you will make many important decisions about how and when to market your crops. Your marketing decisions should be closely tied to the type of commodities you produce, the size of your operation, and your own personality, resources, and skills. Your success in farming will depend in large part on the marketing decisions you make.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS	
PREREADING:	Read *Marketing Challenge in Oklahoma's Produce Industry: Grower Perspective*, OSU Extension Facts No. 513.
WRITING:	Write a short essay (one paragraph to one page) on one aspect of marketing produce.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Describe variables that make up the marketing process.
2. Complete statements about factors that add dollars to the marketing cost of products.
3. Discuss factors that influence the share which producers receive on commodities.
4. Discuss factors which determine whether to sell by the pound or by the bushel.
5. Discuss factors which influence time to market.
6. Discuss advantages and disadvantages of home storage and commercial storage.
7. Explain the types of elevators.
8. List factors which determine the federal grades of grain.
9. Compare marketing channels.
10. Explain the principles of using forward marketing, the futures market, and hedging.
11. List sources of crop marketing information.
12. List methods of marketing crops.
13. Discuss markets for specialty crops.
14. Discuss sources of funding for nontraditional enterprises.
15. Calculate break-even prices. (Assignment Sheet 1)
16. Interpret market information. (Assignment Sheet 2)
17. Identify sources of information and support organizations for specialty enterprises. (Assignment Sheet 3)

INFORMATION SHEET

MARKETING CROPS AND GRADES

E-1

OBJECTIVE 1

Optional Activities/ Resources in Instructor's Guide

Describe variables that make up the marketing process.

WORDS YOU SHOULD KNOW	
variables	things or aspects that can change; how they change determines their effect
allocated	distributed as a share or portion, often through a political process, like passage of a law in Congress or in a state legislature
pesticide	a substance for destroying harmful pests

Variables in the marketing process include:

- World politics, which dictates:
    - the size, cost, and type of commodities that the U.S. can import and export
    - with which countries the U.S. can establish marketing agreements
    - demand for U.S. products in other countries
- Weather, which can impact:
    - supply
    - quality of crops
    - time of harvest

- Crop conditions, which determine:
    - types of markets that will accept the produce
    - usable yield
    - price crops can command

      ☑ **NOTE:** Price is not solely determined by crop conditions, but they do play an important role.
- Political climate, which impacts:
    - the passage of laws and policies that affect agriculture
    - whether existing agricultural policies will be allowed to continue
    - the level and type of assistance farmers can expect to receive in the future
    - the amount of money allocated to agricultural agencies and their programs
    - the number, type, and size of government loans available to farmers
- Government payments
- Consumer needs, which help dictate:
    - demand for a commodity
    - how commodities are used (whether they need to be processed and, if so, in what manner)
    - the use of pesticides and other chemicals
    - type of packaging
    - labelling requirements
    - government safety regulations

OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

Complete statements about factors that add dollars to the marketing cost of products.

WORDS YOU SHOULD KNOW	
place utility	the value of a commodity, based on how easy it is for consumers to buy
retail	the selling of goods to the general public
wholesale	the selling of goods in large amounts so they can be retailed by others

Advertising can greatly add to the cost of marketing products. Individual farmers seldom have advertising costs. Producing groups, wholesalers, and retail stores usually pay all advertising costs for farm products.

The cost of marketing agricultural products is most often affected by physical functions like:

Transportation

- Food has to get from the farmer's field to where consumers can buy it.
    - Depending on the product, there may be several stops for processing or storage between the field and the store.
    - Perishable products require more expensive modes of travel, such as refrigerated trucks or railroad cars.
- The greater the distance between the farm where a product is developed and the place where it is sold to the consumer, the greater the cost for transportation.
- Market prices and the cost for transportation to a given market determine the profitability of selling products in that location.

  EXAMPLE: If wheat is more valuable at location A than at location B, then transportation to A adds a place utility to the wheat.
- On average, transportation costs account for 6% to 12% of the total retail price of a farm product.

Processing

- Typically, processing involves sorting and inspecting.
- Processing activities, which include baking, canning and packaging, often transform commodities into a form or product that can be sold to consumers.
- Processing costs are estimated to equal one-third of the total marketing costs for all food products.

Storage

- Once a farm product is harvested it must be stored somewhere until it is consumed.
- Farm products are usually stored in barns, grain elevators, warehouses, or cold storage facilities.
- The length of time an item is stored and the type of facility where it must be kept helps to determine storage costs.

☑ **NOTE:** Storage is by far the smallest of the three factors that add to the cost of marketing products.

OBJECTIVE 3

Optional Activities/ Resources in Instructor's Guide

Discuss factors that influence the share which producers receive on commodities.

WORDS YOU SHOULD KNOW	
agribusiness	any firm involved in marketing agricultural products or supplying farm inputs
farmer's share	the amount or percentage that the farm price equals of the eventual retail price for the same product
price spread	the USDA term for the difference between the price farmers receive (farmer's share) and the amount consumers pay for the same product

The producer's share of the eventual retail price of a commodity is determined by:

- how much profit agribusinesses make on the sale, and

- how much those same businesses have to spend for:
    - labor in getting the product to the consumer
    - processing/packaging the product
    - advertising the product
    - storing the product
    - transporting the product
    - depreciation costs
    - interest on the investment
    - insurance
    - taxes
    - shrinkage
    - quality deterioration
    - quality maintenance (aeration and pesticides)

Farmer's receive the highest percentage on those products that change the least in going from the farm to the retail store.

EXAMPLE: Fresh produce.

OBJECTIVE 4

Discuss factors which determine whether to sell by the pound or by the bushel.

Optional Activities/ Resources in Instructor's Guide

WORDS YOU SHOULD KNOW	
bushel	a unit of dry measurement equaling 32 quarts or 2,150.42 cubic inches

☑ **NOTE:** Farmers seldom, if ever, get to determine whether their crops are sold by the bushel or by the pound. This is almost always decided by the assembler or processor.

Whether a commodity is sold by the bushel or the pound is determined by two factors, the type of crop and the moisture content of the commodity.

EXAMPLE: Due to their size and shape, it wouldn't be practical to sell watermelons and pumpkins by the bushel. So, they are sold by the pound.

- moisture content in the commodity
    - ☐ determines the weight of a specific supply of grain
    - ☐ varies in different crops of the same type of commodity
        - ▸ The amount of rain around time of harvest and when crops are loaded in storage or transportation facilities affects moisture content.
        - ▸ The time of harvest (whether it was early or late in the season) can affect the moisture content.

OBJECTIVE 5

Optional Activities/
Resources in
Instructor's Guide

Discuss factors which influence time to market.

WORDS YOU SHOULD KNOW

supply	the amount of a commodity that farmers are willing to sell at a given price
demand	the amount of a commodity that buyers are willing to purchase on the open market at a given price

Factors which influence when farmers take their commodities to market include:

- weather
    - ☐ It's usually best not to load and unload produce in bad weather.
    - ☐ Some storage facilities don't lend themselves to holding produce through certain types of weather.
    - ☐ Farmers may not have the type of transportation that works well for transporting certain crops in very hot, cold, or wet weather.

- supply and demand
    - ☐ Supply and demand work together to help determine price and the best time to market.
        - ▸ If supply is up and demand is down, price is probably low, so it's usually best to wait to market.
        - ▸ If supply is down and demand is up, price is likely to be high, making it a good time to market.
- storage costs
    - ☐ If storage prices exceed any gains that can be made by waiting for a higher price, it's best to go ahead and market.
    - ☐ If storage prices are low and prices are likely to rise significantly, it's best to wait.
- personal financial condition

  EXAMPLE: Someone who needs cash may need to sell their crop immediately to cover expenses.
- price peaks
    - ☐ If the price peaks unexpectedly while your crop is in storage, it's often best to sell then.
    - ☐ If price trends or cycles indicate the price may peak at a certain time, it may be best to plan to market at that time.

OBJECTIVE 6

Discuss advantages and disadvantages of home storage and commercial storage.

Optional Activities/
Resources in
Instructor's Guide

WORDS YOU SHOULD KNOW	
public warehouse	a business that provides storage for a fee to the public
negotiable	able to be converted into cash or transferred to another person
warehouse receipts	negotiable certificates public warehouses issue indicating ownership of the described goods

ADVANTAGES OF HOME STORAGE

- If a commodity is stored for a long time, on-farm storage can be less expensive than commercial.

  ☑ **NOTE:** Commercial storage rates are usually calculated on a daily basis, while on-farm storage costs are figured on an annual basis.

- Government grain reserve programs often protect farmers against price falls, which helps to cover certain home storage costs.
- On-farm storage allows the farmer to shop for alternative outlets offering the best price.

DISADVANTAGES OF HOME STORAGE

- Home storage comes with risks to the farmer.

  EXAMPLE: The farmer has to incur the cost and trouble of using pesticides and turning the crop to keep it from spoiling. The farmer also has to incur all risk in case of a disaster like fire, tornado, etc.

ADVANTAGES OF COMMERCIAL STORAGE

- Marketing functions are taken care of by the commercial storage facility.
- Commercial storage facilities provide services, such as order processing and shipping, that may be important to a farmer.
- Commercial storage facilities often act as the actual distribution center for certain commodities.
- Public warehouses issue negotiable warehouse receipts to the owners of commodities that they are storing. These receipts can be used to secure loans or to settle a futures contract.

DISADVANTAGES OF COMMERCIAL STORAGE

- Commercial storage usually limits the farmer to accepting whatever price is offered at that facility.
- If a commodity is stored for a long time, commercial storage can be more expensive than on-farm storage.

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

Explain the types of elevators.

WORDS YOU SHOULD KNOW	
elevators	storage facilities for harvested grain

There are two basic types of elevators:

- country points
    - ☐ usually cooperatives
    - ☐ scattered throughout the state
    - ☐ used by local farmers with small to average size crops
    - ☐ market to terminals and/or wholesalers
- terminals
    - ☐ are located regionally
    - ☐ receive commodities from:
        - ▸ farmers with extremely large crops
        - ▸ country points
    - ☐ market to wholesalers, processors, brokers, and buyers

OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

List factors which determine the federal grades of grain.

WORDS YOU SHOULD KNOW

dockage	foreign material in harvested grain such as weed, seeds, chaff, and dust
foreign material	all matter other than wheat which remains in the sample after dockage and shrunken and broken kernels have been removed
test weight per bushel	the weight per winchester bushel (2,150.42 cubic inches) as determined using a federally approved device in the prescribed manner

Grain is graded according to:

- test weight per bushel
- class and subclass
- any damage due to:
  - ☐ heat
  - ☐ mold
  - ☐ fungus
  - ☐ dirt on the exposed part of broken kernels
  - ☐ disease
  - ☐ being green (immature)
  - ☐ germination (show sprout from the germ end)
  - ☐ insect infestation

  - ☐ frost blistering, candied appearance, flaking, or black or brown discoloration
  - ☐ cracks
  - ☐ breaks
  - ☐ chews
  - ☐ garlic bulblets
  - ☐ smut
  - ☐ improper treatment
- the presence of foreign material
- shrunken and broken kernels
- defects
- the presence of other classes of the same type of grain
- the presence of other types of grain

OBJECTIVE 9

Optional Activities/ Resources in Instructor's Guide

Compare marketing channels.

WORDS YOU SHOULD KNOW	
marketing channel	the set of businesses that move a commodity from the farm to the consumer
assembler	a person or organization that assembles many small commodity shipments into larger volume units to be sold and/or shipped to processors or wholesalers

All market channels start with a producer (farmer) and end with the consumer or consumers.

- The simplest channel involves nothing more than the producer selling directly to the consumer.

  (producer ---> consumer)

EXAMPLES: Pick-your-own operations, roadside stands, and farmers' markets

☑ **NOTE:** This channel doesn't lend itself to every commodity. It's most often used for fruits, vegetables, and nuts. Commodities sold in this manner must be of the highest possible quality. The advantage of this channel is that it allows farmers to set their own price, allowing them to make the highest possible profit per unit. The disadvantage is that it requires farmers to personally assume all risks (spoilage, accidents, consumers not buying) and expenses (transportation, building or rental costs, any advertising).

- The classic market channel for a typical agricultural commodity involves:

  (producer ---> assembler ---> processor ---> wholesaler ---> retailer ---> consumer)

  - □ a producer growing a commodity
  - □ upon being harvested, the commodity is sent to an assembler
  - □ once the assembler has gathered an adequate amount of the product, it is all sent to a processor
  - □ the processed product is sold to a wholesaler
  - □ the wholesaler markets the product to a retailer
  - □ the retailer makes the product available to the consumer
    - ▸ Value is added to the product at each stage of this channel.
    - ▸ Everyone in this system depends on the other people in the system performing their tasks.
    - ▸ The advantage of this channel for farmers is that it allows them to sell their entire harvest at little or no additional cost. Assemblers sometimes provide harvesting machinery and transportation.
    - ▸ The disadvantage is that farmers can't set the price.

- Sometimes farmers bypass assemblers and deal directly with processors.

  (producer ---> processor ---> wholesaler ---> retailer ---> consumer)

  This requires:

  - a large crop
  - farmers to arrange their own transportation
  - farmers to have the skills and knowledge necessary to find and negotiate with a processor

- Farmers also sometimes bypass both assemblers and processors to deal directly with wholesalers.

  (producer ---> wholesaler ---> retailer ---> consumer)

  - The commodity can't require processing.
  - Volume must be large.
  - Arrangements can sometimes be made so that wholesalers will help with the cost of transportation.
  - Specialized containers are usually required.
  - The product's quality must meet bulk handling standards.
  - The farmer is usually given a set price for the product.

- Farmers can also deal directly with retailers (grocers and restaurants).

  (producer ---> retailer ---> consumer)

  - The required volume of the commodity depends on the size of the outlets.
  - Farmers and sellers bargain with one another on the price, which usually allows the farmer to get a good price.
  - The farmer has to provide all transportation costs and any containers needed for getting the products safely to the retailer.
  - The highest quality commodities are needed.

- ☐ This can provide a long-term outlet for farmers who consistently produce high quality products.
- ☐ It can be difficult to enter this market and to develop customers.

OBJECTIVE 10

Optional Activities/
Resources in
Instructor's Guide

Explain the principles of using forward marketing, the futures market, and hedging.

WORDS YOU SHOULD KNOW	
break-even price	the price a farmer has to receive for a commodity in order to not lose money
basis	the difference between future quotes and cash prices for a commodity at any particular time of any day
futures contract	a legal agreement to make or take delivery of a standard quality and quantity of a commodity at a specified date and price

- **Forward marketing** establishes a contract between the farmer and a buyer. The contract establishes the amount of commodity being sold, specific time and place of delivery, and price and any other terms of the trade.
- With **commodity futures**, no actual physical delivery of a commodity is usually intended. Instead, futures contracts are traded at a specific place, like the Chicago Board of Trade, during established business hours. Farmers sell futures on commodities to help protect against a drop in price.

  ☑ **NOTE:** The Commodity Futures Trading Commission, an independent federal governmental agency, regulates all futures activity.

EXAMPLE: A cotton farmer estimates his yield and costs and generates a break-even price at 50 cents per pound. Due to price projections and information on harvest prices during the past five years, he has reason to believe he could only sell his crop for 52 cents at harvest time. However, sometime during his production season cotton futures prices go up to 60 cents. Since historically, this happens just before prices start to fall, he decides to go ahead and sell futures on his crop at the 60 cents price. This gives him a 10 cent margin over his cost estimate, and an 8 cent margin over the price he is likely to receive at harvest time.

- A farmer hedges a crop by selling futures on it. This practice can be used by farmers with growing crops or those who've just harvested their crops but want to wait to sell their product.
- Hedging provides protection against low harvest-period prices, a falling cash market, and a rising cash market that fails to rise enough to cover the costs of storing the commodity.

OBJECTIVE 11

Optional Activities/
Resources in
Instructor's Guide

List sources of crop marketing information.

WORDS YOU SHOULD KNOW	
disseminate	spread widely
compile	to create or compose something based on material gathered from several sources

- The National Agricultural Statistical Service (NASS)

☑ **NOTE:** The National Agricultural Statistical Service (NASS) gathers data based on estimates from samples. Then, at appropriate intervals, it disseminates information to the general public on planting intentions, acres planted, anticipated yields, total crops, acres harvested, and total production. Monthly information is provided on the current major uses for commodities (export, feeding, etc.) and prices received by farmers.

- The USDA

  ☑ **NOTE:** The USDA publishes comprehensive analyses on the various aspects of supply and demand for specific crops several times each year. These publications include *Feed Situation* (for corn), *Oil Crops Situation* (for soybeans), and *Wheat Situation.*

- Private groups or trade associations for producers of a specific commodity

- Various wire services

  ☑ **NOTE:** Wire services report daily on the cash and futures closing prices at principal markets across the U.S.

- The Federal-State Market News Reports

  ☑ **NOTE:** These reports cover market prices, demand, supply, commodity movement, price support activities, and other relevant information

- Private news services

  ☑ **NOTE:** These private services carry the same type of information as the Federal-State Market News Reports. The main advantage they offer is rapidly complied and disseminated data on production and production intentions, plus instant price data via computer networks.

OBJECTIVE 12

Optional Activities/
Resources in
Instructor's Guide

List methods of marketing crops.

WORDS YOU SHOULD KNOW

direct outlets	farmers selling directly to consumers
nondirect outlets	farmers going through other parties to get commodities to consumers
cooperatives	user-owned and controlled businesses that distribute benefits on the basis of use
marketing orders	a self-help program, directly supervised by the USDA, that is designed to help producers of certain specific commodities to market those commodities in an orderly fashion

Farmers sometimes choose to sell their crops on their own. They can do so through direct or non-direct outlets.

- **direct outlets**

  ☑ **NOTE:** Not every commodity can be sold directly to the consumer without some form of processing. The main crops that can be sold by farmers directly to the consumer are fruits, nuts, and vegetables.

  - ☐ pick-your-own operations
  - ☐ roadside stands
  - ☐ farmer's markets

- **non-direct outlets**

  - ☐ terminal markets - central markets, usually in major cities where several brokers, wholesalers, and distributors are located; produce from several regions is assembled at this point and shipped to grocery stores, restaurants, and chain store warehouses
  - ☐ selling directly to restaurants and grocery stores
  - ☐ dealing directly with processors, wholesalers, and brokers

Farmers often find that by banding together they can have more success with some marketing functions than by acting separately. Group functions include generic promotion of a particular commodity, marketing cooperatives, and bargaining associations.

- **generic promotion**
  - These promotions include advertising and other activities designed to increase demand for the product.

    ☑ **NOTE:** Individual farmers couldn't afford to extensively promote a commodity by themselves. By paying for this collectively, the benefits for each farmer are likely to exceed their individual costs.

    EXAMPLES: Commodity promotion campaigns have been held for California dates, potatoes, cotton, wheat, soybeans, citrus fruit, almonds, and about 75 other products.

- **marketing cooperatives**
  - Centralized cooperatives

    ☑ **NOTE:** These coops are created by farmers.

  - Federated cooperatives

    ☑ **NOTE:** These are created by several cooperatives joining together.

- **bargaining associations**

  ☑ **NOTE:** Although this is a type of cooperative, its duties are much more limited than those of the typical marketing cooperative. Bargaining associations represent their members by collectively negotiating terms of trade. However, they do not engage in the physical side of marketing, such as assembly, processing, and distribution.

  - These organizations carry the most clout when they clearly control a specific commodity.
  - Membership in this type of organization helps individual farmers know they will receive the same price and trade terms as all other growers.

OBJECTIVE 13

Optional Activities/ Resources in Instructor's Guide

Discuss markets for specialty crops.

WORDS YOU SHOULD KNOW	
specialty crops	alternative crops
synthetically	making something through a chemical process rather than through the use of natural material
surplus	an amount left over after what was needed has been used

- The most successful specialty crops in this country are those that either fill a new market or which provide for a market that is currently served through imports. Otherwise, it will simply compete with an established crop.

- The market and production must develop together to insure there is a reliable and consistent supply without saturating the market.

- Exports can't be relied upon to absorb surpluses for specialty crops.

  ☑ **NOTE:** Only those crops that can adapt to Oklahoma's climate should be considered by Oklahoma farmers.

- Specialty crops are needed for:
  - the nutrition and health food industry - fruit and vegetables grown without pesticides to be sold over-the-counter in health food stores and used in the production of vitamins and food supplements; organically-grown produce
  - the soap and cosmetics industry - oils and waxes are needed; also, some specialty lines use plant extracts for such products as oatmeal scrubs, alfalfa soaps, etc.
  - manufacturers - pepper compounds, fiber for making paper, and other items that are either too difficult or too expensive to create synthetically
  - gourmet food outlets and restaurants - special mushrooms, fruits, and vegetables

- ☐ plant stores and nurseries - many types of trees, decorative plants, and flowers
- ☐ seasonal markets - Christmas trees, evergreen wreaths, etc.

OBJECTIVE 14

Optional Activities/ Resources in Instructor's Guide

Discuss sources of funding for nontraditional enterprises.

WORDS YOU SHOULD KNOW	
OALDP	the Oklahoma Agricultural Linked Deposits Program, created by an act of the Oklahoma State Legislature
Farmers Home Administration	the division of the USDA that provides funding for agricultural endeavors

- Under the OALDP, state government deposits funds at below market interest rates in participating banks within Oklahoma. The banks then loan these funds, at below market rates, to:
  - ☐ financially distressed Oklahoma farmers
  - ☐ people who are entering into alternative agricultural enterprises

    ☑ **NOTE:** Under the law, alternative agricultural enterprises include the production and processing of designated agricultural products.

- The Farmers Home Administration (FmHA) provides loans to finance alternative agricultural enterprises.
  - ☐ To be eligible for these loans, applicants must have sufficient applicable education and/or farm or ranch experience to stand a reasonable chance of success in the proposed plan of operation.
    - ▸ To be considered sufficient, the experience must total at least one year of a complete production and marketing cycle within the last five years.
    - ▸ Applicants who do not possess adequate experience in the area of the proposed enterprise will be required to start their operation on a small scale.

947

- As experience is gained and the market increases, the borrower can expand the operation.

☑ **NOTE:** Information about both types of loans can be obtained from the Oklahoma Cooperative Extension Service by calling 1-800-522-3755.

OBJECTIVE 15 **Complete Assignment Sheet 1.**

OBJECTIVE 16 **Complete Assignment Sheet 2.**

OBJECTIVE 17 **Complete Assignment Sheet 3.**

ASSIGNMENT SHEET 1

MARKETING CROPS AND GRADES E-1

Name ______________________________ Score __________

OBJECTIVE 15

Calculate break-even prices.

INTRODUCTION

Break-even price for hedging is calculated by adding the cash price at harvest to the storage costs per bushel per month. This looks like:

Break-even price = harvest price + (storage costs per bushel x number of months)

EXAMPLE: $4.00 harvest cash price
$.03 per bushel per month
9 months storage time

$4.00 + ($.03 x 9) = $4.27 break-even price (This is a per bushel rate.)

INSTRUCTIONS

Operation and Calculation
- Calculate with decimals

Math Application
- Select/apply mathematical formula
- Select/apply mathematical procedure

Answer the questions below.

1. What would be the break-even price for storing wheat 10 months at $.04 per bushel per month, when the cash price at harvest is $4.75?

2. What would be the break-even price for storing wheat 6 months at $.05 per bushel per month, when the cash price at harvest is $4.25?

3. What would be the break-even price for storing wheat 2 months at $.07 per bushel per month, when the cash price at harvest is $4.13?

4. What would be the break-even price for storing grain 1 year at $.03 per bushel per month, when the cash price at harvest is $3.75?

ASSIGNMENT SHEET 2

MARKETING CROPS AND GRADES

E-1

Name ______________________________ Score __________

OBJECTIVE 16

Interpret market information.

EQUIPMENT AND SUPPLIES

- Federal-State Market News Reports, trade association information, or private news reports

INTRODUCTION

There is a great deal of market information available from a number of different sources. Some individuals like and/or need their information updated on a minute by minute basis, while others are satisfied with a monthly or semi-annual report. Three USDA publications that are important to people who produce the specific commodities include: *Feed Situation*, for corn; *Oil Crops Situation*, for soybeans; and *Wheat Situation*, for wheat.

INSTRUCTIONS

Interpret one report by answering the following questions.

Reading Comprehension
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Cognitive Activities
- Collect/record information
- Analyze/synthesize information
- Draw conclusions

1. Name of the report

____

2. Organization that produces the report or information

____

3. What type of information does the report provide?

____

____

____

____

4. How timely is the information?

____

____

5. How might a producer use this information?

____

____

____

____

____

____

ASSIGNMENT SHEET 3

MARKETING CROPS AND GRADES

E-1

Name ______________________________ Score __________

OBJECTIVE 17

Identify source of information and support organizations for specialty enterprises.

EQUIPMENT AND SUPPLIES

- Directory of trade associations

INSTRUCTIONS

Using the above information answer the questions below.

Reading Comprehension
- Gain factual information

Research and Reference
- Use standard references

1. What is the one organization that has information on both federal and state loans (HINT: this agency can also help you with general information and guidance about any type of agricultural endeavor, not just those that are nontraditional).

____

____

____

____

2. Name three support organizations for producers of one specific crop. Be sure to name the crop.

____

____

____

OBJECTIVE SHEET

PRICE TRENDS AND CYCLES

E-2

INTRODUCTION

The farmer most likely to make a profit is the one who gets the best price for a crop that was harvested and marketed at the lowest possible cost to the farmer. To keep profits high and expenses low, farmers must carefully gauge the size, timing, storage, processing, and shipment of all crops. Knowledge about price trends and cycles can give you the information you need to make the best possible decisions for your farming business.

PREREQUISITE

None

FOCUS ASSIGNMENTS

Reading Comprehension
- Gain factual information
- Analyze cause and effect
- Draw conclusions

Language
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition
- Use complete sentences

FOCUS ASSIGNMENTS

PREREADING:	Read *Changing Market Institutions and Trends in Food Consumption*, OSU Extension Bulletin No. 789
WRITING:	Have the students write a short essay (one paragraph to one page) on one trend in food consumption.

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Assignment Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Discuss trends and cycles in the marketing of crops.
2. Discuss supply and demand.
3. List factors that can affect the supply of a commodity.
4. Describe factors that cause shifts in the demand for a commodity.
5. Describe the effect that world production and consumption has on a commodity.
6. Rank countries according to their production of various commodities.
7. Discuss factors affecting prices for farm commodities.
8. Discuss pricing effectiveness.
9. Identify current market trends for one product. (Assignment Sheet 1)
10. Present an oral report on market trends. (Assignment Sheet 2)
11. Plot demand and supply curves. (Assignment Sheet 3)

INFORMATION SHEET

PRICE TRENDS AND CYCLES

E-2

OBJECTIVE 1

Optional Activities/ Resources in Instructor's Guide

Discuss trends and cycles in the marketing of crops.

WORDS YOU SHOULD KNOW	
analytical	the process of examining and interpreting something
statistical	the process of scientifically interpreting information based on numbers

- *Trends* refer to the movement of crop prices over a period of time. This period should include at least two times when decisions are made about production levels or two crop years. However, trends can indicate price movement over several decades.

- There are a number of different ways to measure and describe trends. Some of these approaches provide an analytical and/or statistical method for predicting what crop prices will do in the future. Others simply show price levels at specific times in the past.

- A *cycle* is similar to a trend in that it deals with price movements over a period of time. However, a cycle involves a series of market movements that happen regularly over a long period of time. Trends, on the other hand, are general market movements that occur in no particular order.

  ☑ **NOTE:** Price cycles cannot predict the exact price of a crop, the level of growth, or dips in prices from one year to the next. However, price cycles do make it clear when the price is *likely* to be at its highest and lowest, for a given crop during the year.

- Cycles are usually caused by production levels, and the resulting availability, of a particular crop. Crops that are only available at certain times of year will have a definite price cycle. Price levels reflect the amount of a particular product available on the open market. The larger the amount available, the lower that product's price.

  ☑ **NOTE:** This concept will be covered more fully in objective 2 of this unit, when supply and demand are discussed.

- Farmers need to be aware of trends and cycles affecting the crops they produce. This information can help the farmer decide how much to produce and when to sell crops.

OBJECTIVE 2

Optional Activities/
Resources in
Instructor's Guide

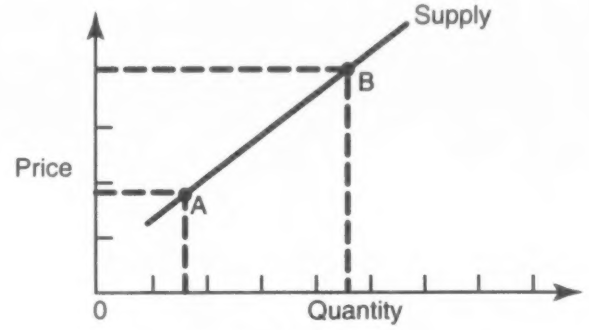
Discuss supply and demand.

WORDS YOU SHOULD KNOW	
commodity	an agricultural product; especially one that is traded
disposable	subject to use, usually exhausted after use or thrown away
elastic demand	consumer use varies according to price; when prices are up buyers will purchase less; when prices are down they will buy more
inelastic demand	consumer use remains relatively steady regardless of price shifts
quantity	a number or amount of something

- **Supply** is the amount of a commodity farmers are willing to sell at a given price.
    - ☐ When prices for a certain commodity or crop are low, farmers sometimes choose to keep that crop off the market and in storage.
    - ☐ If prices are up, farmers will keep less in storage and place more on the market.

- The **law of supply** is the relationship between supply and price. This is illustrated by the **supply curve**. Point A on Figure 1 shows a lower quantity is available when prices are low. Point B illustrates that farmers put more up for sale when crop prices are higher.

FIGURE 1

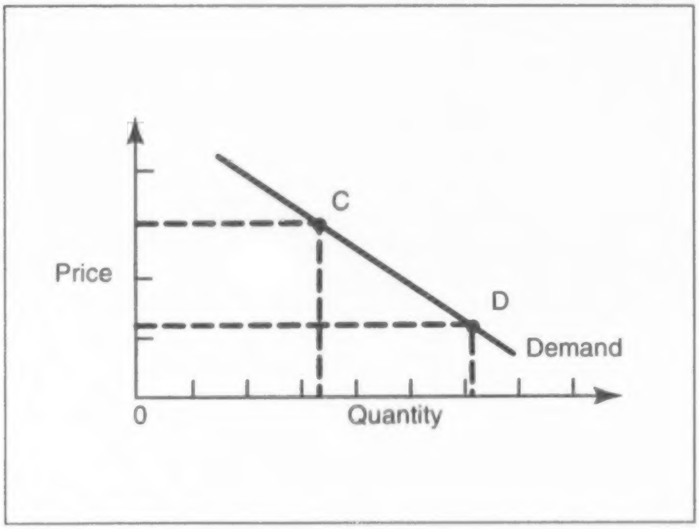


- **Demand** is the amount of a commodity that buyers are willing to purchase on the open market at a given price.

- The **law of demand** is the relationship between demand and price for products with an elastic demand. This is illustrated by the **demand curve**. When prices are up, buyers normally purchase less of these products. When prices are low, consumers are usually willing to buy more.

  This is illustrated below in Figure 2. When prices are high (point C), buyers purchase less than when prices are low (point D).

FIGURE 2



- Products have an inelastic demand if price changes do not significantly affect the amounts consumers purchase.

959

OBJECTIVE 3

Optional Activities/
Resources in
Instructor's Guide

List factors that can affect the supply of a commodity.

- Weather
- Crop yields
- How much is in storage
- Imports and exports
- Technology
- Government programs
- Cost of production
- Market price

OBJECTIVE 4

Optional Activities/
Resources in
Instructor's Guide

Describe factors that cause shifts in the demand for a commodity.

WORDS YOU SHOULD KNOW

disposable income	income which consumers can use to purchase nonessential or luxury items
staples	a major, often considered indispensable, commodity or product
substitute goods	items that can be used interchangeably for something else

The factors that affect demand for a commodity include:

- consumer tastes

  EXAMPLE: Until about 25 years ago, many Americans weren't familiar with avocados. There was little demand for avocados outside of small geographic pockets. Then Mexican food—and guacamole—became more popular, and the demand for avocados rose.

- disposable income
  - ☐ Non-staple items will be purchased less often or not at all when consumers have less money.
  - ☐ When consumers have extra money, they'll treat themselves to luxuries.
- population size
  - ☐ The larger the population, the more consumers there are for products.
  - ☐ When the population declines, so does demand for a product.
- cost of substitute goods
  - ☐ The price of alternative products will affect the demand for a specific commodity.
  - ☐ Demand for a specific product may decrease if consumers can purchase substitute goods at a lower price.

  EXAMPLE: A rise in soybean meal prices will increase demand for other sources of protein in animal feeds.

OBJECTIVE 5

Optional Activities/ Resources in Instructor's Guide

Describe the effect that world production and consumption has on a commodity.

WORDS YOU SHOULD KNOW	
consumption	the act or process of using a good or service
domestic	of one's own country; not foreign or international

The economic stability of U.S. agriculture depends in large part on exports. This situation has occurred because:

- Domestic demand is quite stable, growing by just under 1 percent each year.
- U.S. supply increases by about 1.5 percent each year.

If there were no exports, farm production would have to be scaled back about 0.5 percent per year to keep supply from exceeding demand.

961

Instead, U.S. agricultural exports grow just over 3 percent annually. This allows farm resources to remain nearly stable.

World consumption of a commodity greatly increases demand for the product, raising prices and the need for supply. This can help U.S. farmers who produce this commodity make a profit.

Americans import nearly $20 billion of farm and food products annually. These imports include items like coffee, cocoa, and bananas that do not compete with the temperate zone farm products that the U.S. exports and, therefore, have little effect on demand for U.S. products.

If other countries produce the same products the U.S. produces, the worldwide supply increases. This can lower both demand for and the price of a U.S. commodity, not only in this country but around the world.

OBJECTIVE 6

Optional Activities/
Resources in
Instructor's Guide

Rank countries according to their production of various commodities.

WORDS YOU SHOULD KNOW	
metric ton	a unit of weight equal to 1,000 kilograms (2,205 pounds)
output	the amount produced
trade	the exchange of goods or money for other goods

In the 1980s, American agriculture accounted for 10 percent of world agricultural output, but for 15 percent of world agricultural trade.

The quantities of various commodities produced by the United States and several other countries in 1990 are listed. The countries are listed in order of "rank," or level of production, for each commodity.

The figures reflect the number of metric tons produced.

- Cereals (all--rice, wheat, etc.)

China	401,629
United States	312,069
former Soviet Union	209,123
Canada	56,797
Bangladesh	27,750

- Soybeans

United States	52,416
China	11,000
Canada	1,262
former Soviet Union	878
Japan	220

- Fruits

United States	24,310
China	17,692
Japan	4,906
former West Germany	4,036
Australia	2,313

- Vegetables

China	114,025
United States	31,975
former Soviet Union	31,651
Japan	14,472
former West Germany	2,878

OBJECTIVE 7

Optional Activities/
Resources in
Instructor's Guide

Discuss factors affecting prices for farm commodities.

WORDS YOU SHOULD KNOW	
equilibrium price	also known as market price; point at which the quantity supplied equals the quantity demanded
intersection	the point at which two lines cross each other

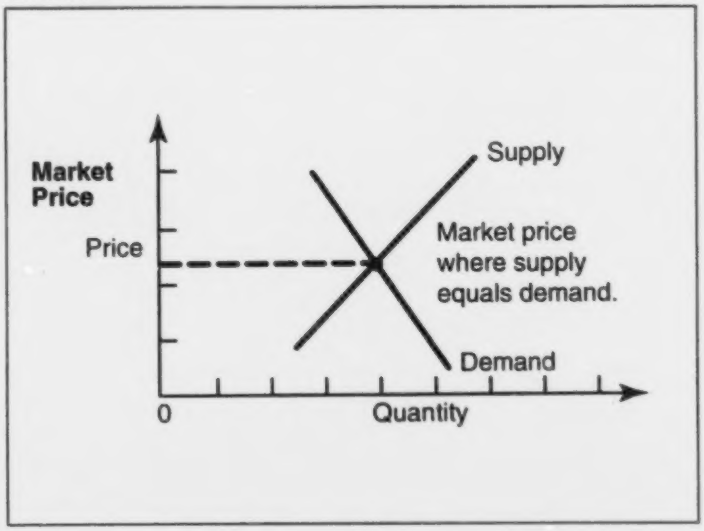
Together, supply and demand determine the market price of a commodity. When either supply or demand change, the market price may also change in the manner shown below:

SUPPLY + DEMAND = PRICE

WHEN SUPPLY IS	AND DEMAND IS	THEN THE PRICE WILL
Up	The Same	Fall
Down	The Same	Rise
The Same	Up	Rise
The Same	Down	Fall

The **equilibrium price** of a commodity is the point at which the quantity supplied equals the quantity demanded. As Figure 3 below shows, the market price of a commodity is determined by the intersection of the supply curve and the demand curve.

FIGURE 3



OBJECTIVE 8

Optional Activities/
Resources in
Instructor's Guide

Discuss pricing effectiveness.

WORDS YOU SHOULD KNOW	
price determination	pricing of a commodity based on the product's current level of supply and demand
price discovery	pricing of a commodity in the future, based on estimates and expectations of supply and demand
effectiveness	accuracy, usefulness for intended purpose

Key aspects of pricing effectiveness include:

- price determination
    - ☐ In this instance a price is "determined" for a farm commodity based on the product's level of supply and demand. Potential levels of price are calculated for various supply/demand combinations. When either supply or demand for the commodity shifts, the price is also changed to whatever level has been set for the new supply/demand combination.
    - ☐ This form of pricing is based on what is given and known.
    - ☐ Price determination is very effective for helping decide what to pay or charge for a commodity that is currently being marketed or one that will be on the market in the immediate future. Price determination can't help with long-term projections or decisions.
- price discovery
    - ☐ With this type of pricing buyer and seller interactions and price negotiations are based on "estimates and expectations" of supply and demand.

- ☐ Instead of relying on what is known, as with price determination, price discovery projects into the future using such practices as:
  - ▸ formula pricing, where the price is tied to some market report or other formula indicator
    - Formula pricing is only effective for those who have the time and money to do the necessary research. Small operators--both buyers and sellers--could run into serious problems using this pricing method.
  - ▸ committee pricing, in which a committee comprised of representatives for both buyers and sellers estimates the future supply and demand levels and agrees on a price based on those expected levels
    - This method is only effective if a good job is done in analyzing supply and demand to establish the announced price level.
  - ▸ administered pricing, where a buyer or seller announces a price at which he or she will buy or sell
    - As with committee prices, administered prices are only effective if a good job is done in analyzing supply and demand to establish the announced price level.
- ☐ Competitive prices on the open market are vulnerable to daily supply and demand fluctuations. They are also affected by rumor and the tendency to overreact to any perceived change in supply and demand.
- ☐ The resulting variability in price lowers the efficiency level of this type of pricing. As a result, there is a high level of risk for all who use price discovery methods.

OBJECTIVE 8 **Complete Assignment Sheet 1.**

OBJECTIVE 9 **Complete Assignment Sheet 2.**

OBJECTIVE 10 **Complete Assignment Sheet 3.**

ASSIGNMENT SHEET 1

PRICE TRENDS AND CYCLES

E-2

Name ______________________ Score __________

OBJECTIVE 9

Identify current market trends for one product.

EQUIPMENT AND SUPPLIES

- Market data on your chosen product for the past two years

INSTRUCTIONS

Data Analysis and Display
- Collect/record data

Cognitive Activities
- Collect/record information
- Analyze/synthesize information
- Predict results/outcomes

Using the information you've compiled, chart prices for the product, month by month. Answer the following questions on a separate piece of paper.

1. Did prices fall, remain steady, or rise month by month?
2. Was there a constant state of fluctuation or did there seem to be some type of pattern to the price movement? If you saw a pattern, what was it?
3. Based on the information you have, how would you expect prices for the product to move over the next three months?

ASSIGNMENT SHEET 2

PRICE TRENDS AND CYCLES

E-2

Name ______________________________ Score __________

OBJECTIVE 10

Present an oral report on market trends.

EQUIPMENT AND SUPPLIES

- Note cards
- The information and material you developed for Assignment Sheet 1

INSTRUCTIONS

Oral Presentation
- Make informative presentations
- Use good speaking techniques
- Use effective body language
- Present appropriate appearance

Since you've already selected and researched your topic, you can begin on what would normally be your third step:

1. Take notes. Write each point on a separate note card.
2. Arrange the note cards in order. Move the cards around until the information seems to flow logically.
3. Write an introduction. Your opening statement should get the audience's attention and tell them what you are going to talk about.
4. Write the body of the speech. The body of your speech should contain your main points. Each main point should be supported by facts, statistics, or direct quotes from an expert.
5. Write your conclusion. Your conclusion should make your point in one, easy to understand sentence.
6. Practice making the speech.
    - A. Time yourself. Make sure your report lasts the assigned length of time.
    - B. Don't write out your whole speech. It will sound stiff. Instead, memorize your introduction and conclusion, look at the facts on your note cards, and put everything in your own words.

PRICE TRENDS AND CYCLES

Name ______________________________ Score __________

OBJECTIVE 11 **Plot demand and supply curves.**

INTRODUCTION As shown in Figure 4 below, the supply curve shifts right when supply increases, and shifts left when supply decreases.

FIGURE 4

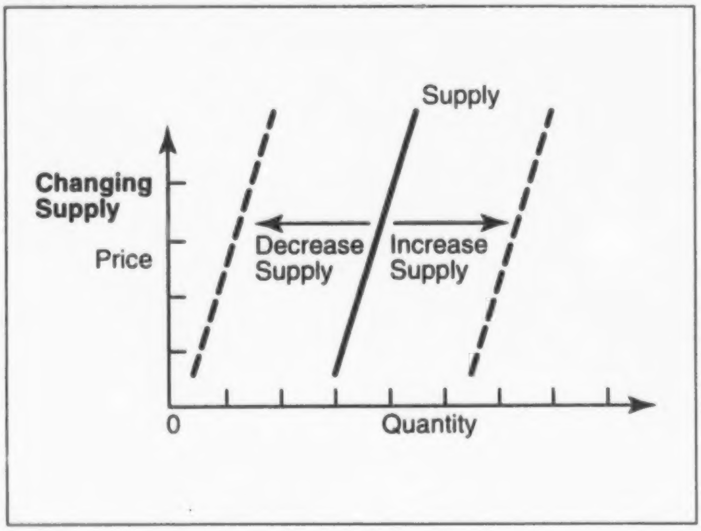
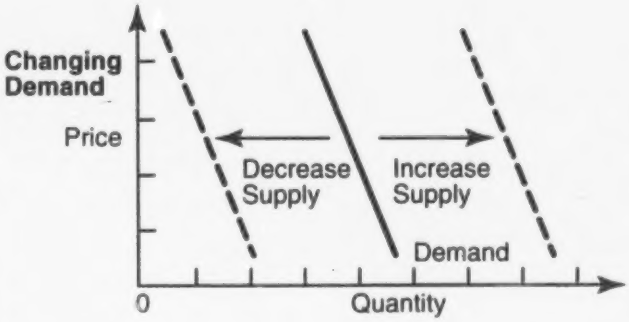


Figure 5, below, illustrates that the demand curve also shifts right when demand increases and left when it decreases.

FIGURE 5



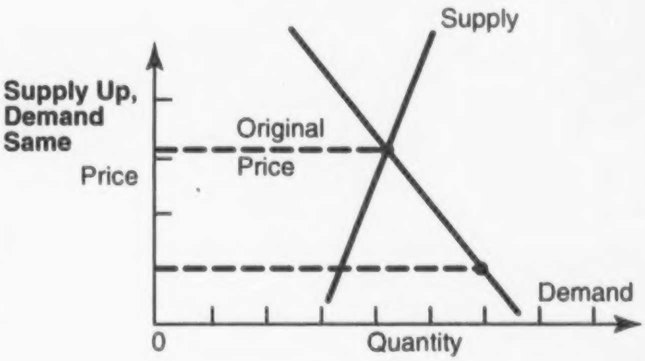
INSTRUCTIONS

Data Analysis and Display
- Interpret graphs

Figure 6 shows the equilibrium price for cotton. Make four copies of this chart. Plot whether the price of cotton would go up or down in each of the following situations. Use a new chart for each situation and be sure to label each chart according to the situation plotted.

1. supply increased
2. supply decreased
3. demand increased
4. demand decreased

FIGURE 6



Computer Software Series
CSS-47

NPK$PLUS:
AN INTERACTIVE MICROCOMPUTER PROGRAM TO INTERPRET SOIL TEST RESULTS AND TO EVALUATE THE ECONOMICS OF ALTERNATE FERTILIZER APPLICATION RATES

VERSION 4

Gordon V. Johnson
David L. Nofziger
and T. Dwayne Hunter

AGRONOMY
FEBRUARY 1991

COOPERATIVE EXTENSION SERVICE
DIVISION OF AGRICULTURE
OKLAHOMA STATE UNIVERSITY

NPK$PLUS

An Interactive Microcomputer Program to Interpret Soil Test Results and to Evaluate the Economics of Alternate Fertilizer Application Rates

Version 4

Gordon V. Johnson
David L. Nofziger
and T. Dwayne Hunter

Department of Agronomy
Oklahoma State University
Stillwater, OK 74078

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972

Foreword

NPK$PLUS is a computer program written for use on the IBM[1] PC, XT, AT, PS/2 and compatible computers having 640 K bytes of random access memory and at least one floppy disk drive. PC-DOS or MS-DOS 2.0 (or a later version) is also required. A printer is useful but not essential. NPK$PLUS is distributed on floppy diskettes. Once it is installed and loaded properly, the user needs no prior computer experience to operate it.

NPK$PLUS is based on a mathematical model which describes crop yield as a general function of soil fertility, previous yields, previous fertilizer practices, yield goal, and environmental stress. Details of the model are provided in the manual. The model was developed by Dr. G. V. Johnson and questions regarding it may be addressed to him. NPK$PLUS was developed from the model by Dr. D. L. Nofziger and T.D. Hunter. Questions on use of the software may be addressed to them. Correspondence to either may be addressed to:

Department of Agronomy
Oklahoma State University
Stillwater, OK 74078

Version 4.0 of NPK$PLUS has the following changes from the previous versions:

1. The nitrogen requirement for any set of growing conditions is not determined until after restrictions on obtaining the yield goal are evaluated. These restrictions include less than optimum levels of phosphorus, potassium, environmental factor, and soil pH.

2. A yield reduction is calculated for wheat whenever the pH is less than 5.5 and lime is not added as a soil amendment prior to planting.

3. An option is available to identify the most profitable use of limited capital when fertilizing more than one field must be considered.

---

[1] IBM is a trademark of International Business Machines, Inc.

Disclaimer

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TABLE OF CONTENTS

FOREWORD 1

DISCLAIMER 2

INTRODUCTION 3

HARDWARE AND SOFTWARE REQUIREMENTS 5

OPERATING CONVENTIONS 6

INSTALLATION 9

PROGRAM EXECUTION 12

ILLUSTRATIONS OF SOFTWARE FEATURES 13

  Main Menu 13

  Using Option A-Interpret Soil Test for One Field 16

  Using Option B-Estimate Yield and Return for a Specific Fertilizer Application 24

  Using Option C-Optimize Fertilizer Rates for Several Fields and Limited Capital 26

MATHEMATICAL BASIS OF MODEL 34

NPK$PLUS

Gordon V. Johnson and David L. Nofziger
Department of Agronomy
Oklahoma State University

NPK$PLUS is designed as a decision-making tool for interpreting soil tests and selecting fertilizer application rates. Soil test results provide indices for the amounts of nitrogen, phosphorous, and potassium available in the soil. To be useful, these soil test values must be calibrated. That is, research must be carried out to identify the amount of yield reduction associated with nutrient levels when there is a nutrient deficiency, and also how much fertilizer nutrient must be applied to eliminate the deficiency for one year.

One purpose of this software is to interpret the user's soil test results for a specific field and to display the fertilization practice suggested for long term productivity (supply the amount of nutrient to eliminate the deficiency for one year). These practices will usually suggest enough fertilizer so the overall fertility level of the field is as high or higher than it was the previous year.

NPK$PLUS also provides short term fertilization options which maximize the return on fertilizer investment for a single year. In times of economic hardship or in cases where farmers have only short term leases on land, they may be willing to use some of the nutrient reserve in the soil without replacing it. In this case, they want to know the effect of applying a lesser amount of fertilizer on the yield, and on the economic return for a fertilizer investment. These short-term options are based on estimated yields for the selected crop under different fertilizer practices, the user's estimates of the value of the crop, fertilizer nutrient costs, and general growing conditions.

In addition to providing this soil test interpretation, the software can be used to estimate the yield and economic return from a user-specified fertilization practice. Thus, it can be used to compare the options described above with traditional fertilization practices.

Finally, NKP$PLUS can be used to determine optimum fertilizer practices for a collection of fields and crops. Thus, if a farmer chooses to limit the total amount of money invested in fertilizer, this software will suggest the way that money should be spent to maximize return on this investment.

This program uses soil test results and cropping history specific for an individual field. The data used to interpret the soil test results and to predict yields are provided for your area by your state extension soil fertility specialist. For more specific information, contact the state extension agent listed on the first screen of your program.

NPK$PLUS will not calculate a "guaranteed" return or profit from the use of fertilizers. It is a management tool designed to help you in planning fertilizer use. Keep in mind also that:

1. The program is designed to find the most economical one-year use of fertilizer and does not take into account the value of build-up of nutrients for subsequent years.

2. If the model projects a loss (negative return), then fertilizing the crop under the same conditions that you enter into the program is a questionable farming practice. You should consider alternative crops or conditions (such as yield goal) which can realistically be changed.

3. When nutrients are adequately provided by the soil, fertilizer application will not improve crop yield or quality.

HARDWARE and SOFTWARE REQUIREMENTS

NPK$PLUS is a computer program written for use on the IBM[2] PC, XT, AT, PS/2 and compatible computers with at least 640 K bytes of random access memory (RAM) and at least one floppy disk drive. A math coprocessor (8087, 80287, or 80387) is not essential but will speed up the program operation, especially optimizing fertilizer rates for several fields. A printer is useful, but not essential.

PC-DOS or MS-DOS 2.0 (or a later version) is also required. The ANSI.SYS file from your DOS diskette must be executed by means of a CONFIG.SYS file before you operate this software. A sample CONFIG.SYS file is provided on the distribution diskette.

---

[2] IBM is a trademark of International Business Machines, Inc.

OPERATING CONVENTIONS

Manual conventions:
In this manual, words or characters that you should enter are underlined. Special keys which must be pressed are shown between carets. For example, to execute this program, you will need to enter

NPK<ENTER>

This notation means you will enter the characters "N", "P", "K" and then press the <ENTER> key.

Single letter selections:
Choosing options from a menu is done by pressing the key corresponding to the letter of the option. The <ENTER> key need not be pressed. The same applies to responses for yes/no questions.

Default values:
NPK$PLUS makes use of "default" values, which are displayed on the screen when inputs are requested. The default values represent commonly found values or average values for wheat grown in Oklahoma. They provide an "example" of values to be used, but are not intended to apply to a specific field situation. If the default value is acceptable, there is no need to enter the value again. Use the arrow keys to move the cursor to the next entry. Once default values have been changed to those of a specific field situation, these values then become the new default values for operating OPTION A (see page 22).

Filenames:
You are allowed to use any legal MS-DOS or PC-DOS filename which is a combination of up to eight letters, numbers, or the characters $ % ' - @ { } ( ) & _ ~ '. Blank spaces are not allowed. For example, NORTH40 and NORTH-40 are legal (DOS) file names, but NORTH 40 is not.

SPECIAL FUNCTION KEYS:

At various places in the software, cursor control keys and other special function keys are used. The following is a list of these keys and a description of their functions.

<UP-ARROW>	Pressing this key moves the cursor up one line. If it is already on the first line the cursor will move to the last line on the screen.
<DOWN-ARROW>	Pressing this key moves the cursor down one line. If the cursor is on the last line of a screen, it will be moved to the first line.
<LEFT-ARROW>	Pressing this key moves the cursor left one character. If the cursor is already at the beginning of the entry, this key does nothing.
<RIGHT-ARROW>	Pressing this key moves the cursor right one character. If the cursor is at the end of the entry, this key does nothing.
<ENTER>	This key is used to end the entry of characters on a particular line. Characters to the right of the cursor are dropped and the cursor moves down one line. If the cursor is at the beginning of the current line, this key does nothing.
<DEL>	Deletes the character at the current cursor location.
<BACKSPACE>	Deletes the character at the left of the current cursor location.
<HOME>	Moves the cursor to the first line on the current screen.

<END>	Move the cursor to the last line on the screen.
<PgUp>	Some options use more than one screen for data entry or display. If the screen being displayed is not the first screen in the sequence, this key is used to display the preceding screen. If the first screen is displayed, pressing this key will cause the last screen in the sequence to be displayed.
<PgDn>	Some options use more than one screen for data entry or display. If the current screen being displayed is not the last screen in the sequence, this key is used to display the next screen. If the last screen is already displayed, pressing this key will cause the first screen to be displayed.
<F1>	Help messages are provided at most places where you are expected to enter data. Pressing the <F1> key will display this information at the bottom of the screen.
<F10>	The full-screen editors are designed to enable you to move forward and backward through the entries. When you are finished making all the entries on all the screens, pressing <F10> instructs the system to proceed to process the data.
<ESC>	This key aborts the present option and returns the screen to the main menu of the program.

INSTALLATION

Files on distribution diskette

The software is distributed on one floppy diskette. The following files are included:

NPK.EXE	This file contains the executable program.
NPK.DAT	This file contains data necessary to interpret soil test results and predict yields for your area. The name of the specialist who developed this local input is displayed on the first screen of the program.
README	This file contains the latest information on the program and its operation. Read it before using the program. If the diskette is in drive A, the file can be displayed on the screen by entering the DOS command TYPE A:README<ENTER>
CONFIG.SYS	This is a simple CONFIG.SYS file which installs the ANSI.SYS device. It will be used only if your present system does not have a CONFIG.SYS file on the boot-up diskette.
HELP.DAT	This file is the library which contains the help message information for the software.

SOFTWARE INSTALLATION

Installation instructions are given below for computers with a fixed disk and with floppy disks. After installation, store your original diskette in a dry, clean place away from extremes in temperature in case it is needed again.

Fixed-disk systems

1. Make a new directory for this software using the MKDIR command of DOS. For example, to make the directory NPK in the root directory of drive C, enter

   ```
   MKDIR  C:\NPK<ENTER>
   ```

2. Copy the contents of the distribution diskette to the new directory using the COPY command. If the distribution diskette is in drive A and the new directory was created as above, copy the contents by entering

   ```
   COPY A:*.*  C:\NPK<ENTER>
   ```

3. If your system already contains a CONFIG.SYS file, check to see if it contains a line

   ```
   DEVICE=ANSI.SYS
   ```

   If it does, no additions need to be made. If it does not, add this line to the CONFIG.SYS file. If your system does not contain a CONFIG.SYS file in the root directory, create one containing the line shown above or copy the CONFIG.SYS file provided on the installation floppy to the root directory of drive C:.
   NOTE: If the DOS programs are stored in a separate directory on your fixed-disk, the name of that subdirectory must precede ANSI.SYS. For example, if the DOS programs are in a subdirectory \DOS, the line should be

   ```
   DEVICE=\DOS\ANSI.SYS
   ```

Floppy-disk systems with 2 disk drives

1. Format a working diskette with the /S option of the DOS FORMAT command so that this disk can be used to boot-up the computer. To format a diskette, place the DOS diskette in drive A and a new disk in drive B and then enter the command

   ```
   FORMAT B:/S<ENTER>
   ```

2. Copy the ANSI.SYS file from the DOS diskette to the working diskette using the command

   ```
   COPY A:ANSI.SYS B:<ENTER>
   ```

3. Remove the DOS diskette from drive A and replace it with the distribution diskette. Copy all files from the distribution diskette to the working diskette using the command

   ```
   COPY A:*.* B:<ENTER>
   ```

   If you do not routinely need a CONFIG.SYS file on your boot-up disk, this will make the working disk complete. If you routinely use a CONFIG.SYS file for boot-up, you will need to copy that file to the working diskette and make sure it contains a line

   ```
   DEVICE=ANSI.SYS
   ```

This completes the working diskette.

Floppy-disk systems with 1 disk drive

A working diskette can be made on a system with one disk drive by following the same steps as those outlined for 2 drives. In this case you will need to swap diskettes in and out of the single disk drive as prompted by the system.

Program Execution

1. Before executing the program, reboot the computer using the working diskette or the fixed disk with the modified CONFIG.SYS file.

2. Make the disk drive or disk subdirectory containing the NPK software the default disk drive.

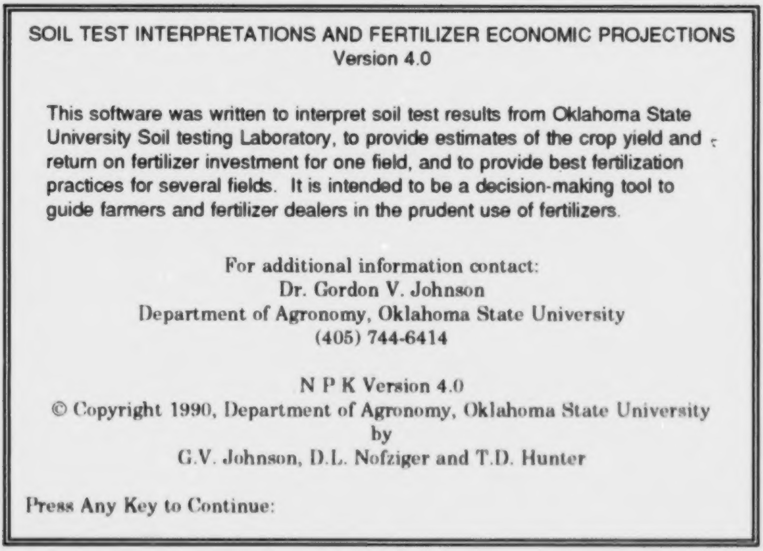
3. Execute the program by entering

NPK<ENTER>

Illustrations of Software Features

Main Menu

NPK$PLUS is designed to be used after you have obtained soil test results for the fields of interest. Figure 1 shows the introductory screen and Figure 2 shows the main menu and options available. These figures are followed by examples and illustrations of each option.



SOIL TEST INTERPRETATIONS AND FERTILIZER ECONOMIC PROJECTIONS
Version 4.0

This software was written to interpret soil test results from Oklahoma State University Soil testing Laboratory, to provide estimates of the crop yield and return on fertilizer investment for one field, and to provide best fertilization practices for several fields. It is intended to be a decision-making tool to guide farmers and fertilizer dealers in the prudent use of fertilizers.

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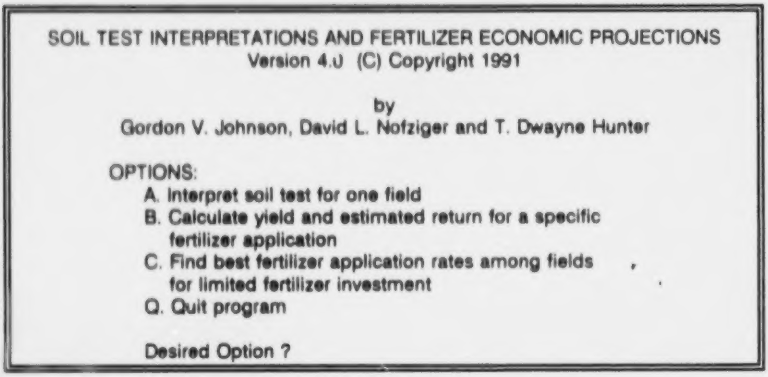
(405) 744-6414

N P K Version 4.0
© Copyright 1990, Department of Agronomy, Oklahoma State University
by
G.V. Johnson, D.L. Nofziger and T.D. Hunter

Press Any Key to Continue:

Figure 1. Introductory screen stating purpose of the software and the specialist responsible for it.



```
SOIL TEST INTERPRETATIONS AND FERTILIZER ECONOMIC PROJECTIONS
Version 4.0 (C) Copyright 1991

by
Gordon V. Johnson, David L. Nofziger and T. Dwayne Hunter

OPTIONS:
   A. Interpret soil test for one field
   B. Calculate yield and estimated return for a specific
      fertilizer application
   C. Find best fertilizer application rates among fields
      for limited fertilizer investment
   Q. Quit program

   Desired Option ?
```

Figure 2. Main menu with program options

Option A - Interpret Soil Test for One Field

This option enables the user to enter soil test information, desired crop, management history, fertilizer costs, and projected crop value for a specific field. The program interprets the soil test information and displays fertilizer requirements for long range productivity. It then displays the 10 best fertilizer use options for maximizing return on fertilizer investments for one year.

Option B - Calculate Yield and Estimated Return for a Specific Fertilizer Application

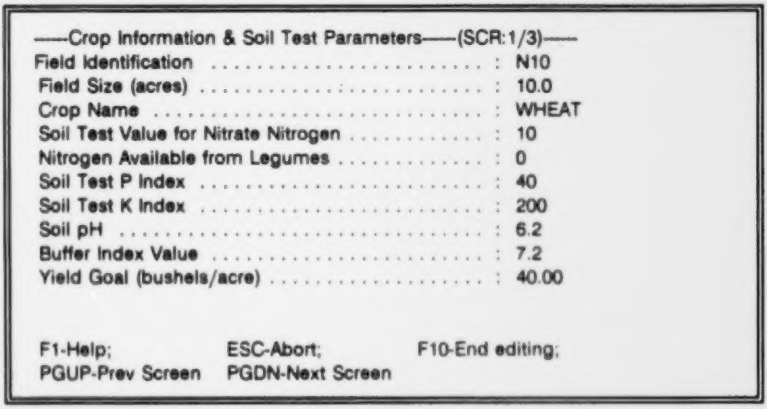
This option is used to estimate the yield, cost, and return on a specific fertilizer application practice selected by the user. This enables the user to compare the choices found in Option A with traditional or other proposed fertilizing practices, including no fertilizer use.

Option C - Find Best Fertilizer Application Rates Among Fields for Limited Fertilizer Investment

Frequently, a producer has a limited amount of money to invest in fertilizers. This producer commonly has more than one field to manage. In this case the individual wants to invest that money to obtain a maximum total return from all fields. This option enables the user to define crop, soil test information, and economic information for each of a set of fields. The system then finds fertilizer rates for each field which will maximize return from fertilizer for the entire farm.

USING OPTION A
Interpret Soil Test for One Field

Parameters required for the system to interpret soil tests and estimate yield and returns for different practices are entered on three screens by means of a full-screen editor. The user can move from screen to screen using the <PgUp> and <PgDn> keys. When all the entries on all screens (two for legumes, otherwise three) have been entered, the <F10> key should be pressed to process the information entered. The first screen, shown in Figure 3, is for entering crop and soil test information. An explanation of each entry follows.



```
-----Crop Information & Soil Test Parameters-----(SCR:1/3)-----
Field Identification ........................ : N10
 Field Size (acres) ......................... : 10.0
 Crop Name .................................. : WHEAT
 Soil Test Value for Nitrate Nitrogen ....... : 10
 Nitrogen Available from Legumes ............ : 0
 Soil Test P Index .......................... : 40
 Soil Test K Index .......................... : 200
 Soil pH .................................... : 6.2
 Buffer Index Value ......................... : 7.2
 Yield Goal (bushels/acre) .................. : 40.00


 F1-Help;            ESC-Abort;          F10-End editing;
 PGUP-Prev Screen    PGDN-Next Screen
```

Figure 3. Entering crop and soil information

Field Identification:

This is a descriptive identifier for the field being analyzed. It is used for your reference.

Note: In Option C, this entry is the file name for the field.

Field Size:

This is the area, in acres, occupied by this field.

Crop Name:

This is the name of the crop to be grown in the field. Only crops for which soil test calibration data is available are listed. The following crops are acceptable for Oklahoma:

ALFALFA
BARLEY
BERMUDA GRASS
CORN
CORN SILAGE
COTTON
COW PEAS
FESCUE
MUNG BEANS
GRAIN SORGHUM
GUAR
ORCHARD GRASS
NATIVE HAY
OATS
SORGHUM-SUDAN HAY
PEANUTS
RYE GRASS
WHEAT PASTURE
SOYBEANS
WHEAT
WEEPING LOVEGRASS

Soil Test Value for Nitrate Nitrogen:

This is the value of nitrate nitrogen reported by the soil test laboratory. Soil test nitrogen is the available nitrogen measured as nitrate nitrogen.

Nitrogen Available from Legumes/Manures:

This is an estimate of the amount of nitrogen available from a previous legume crop or animal manures. Estimates of amounts from legumes can be obtained by pressing the <F1> key for help when the cursor is on this line. Amounts of nitrogen from animal manures will vary depending on type of manure and storage or handling procedures. These should be estimated locally or from laboratory analysis.

Soil Test P Index:

This is the soil test phosphorous (P) index from the soil test report. In Oklahoma, it is the Mehlich III P-test value.

Soil Test K Index:

This is the soil test potassium (K) index from the soil test report. In Oklahoma, it represents exchangeable K from ammonium acetate or Mehlich soil test procedures.

Soil pH:

This is the soil pH from the soil test report. In Oklahoma it is measured in a 1:1 soil-water suspension.

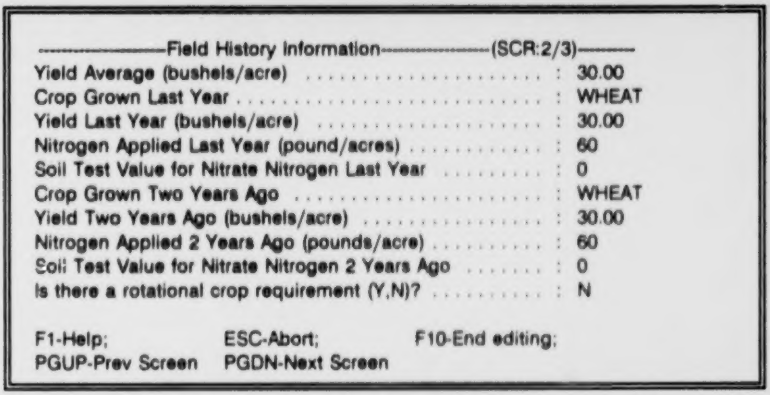
Buffer Index Value:

This index, usually included in the soil test report, is used to determine the amount of lime required to correct a soil acidity problem, if a problem exists. (If the soil test report does not include a buffer index value, enter a period.) In Oklahoma the SMP buffer index is used.

Yield Goal (bushel/acres):

The yield goal is the best yield of this crop, for this field, during the past 5 years or a value about 25% above the average yield, whichever is larger.

The second data-entry screen (Figure 4) is used to enter fertilization and yield history for the field. This information is used to estimate the size of the organic nitrogen reservoir in the soil, and the level of easily mineralized nitrogen in the reservoir. This screen is not used for legume crops.



```
------------------Field History Information----------------(SCR:2/3)--------
Yield Average (bushels/acre) ..................... : 30.00
Crop Grown Last Year ............................. : WHEAT
Yield Last Year (bushels/acre) ................... : 30.00
Nitrogen Applied Last Year (pound/acres) ......... : 60
Soil Test Value for Nitrate Nitrogen Last Year ... : 0
Crop Grown Two Years Ago ......................... : WHEAT
Yield Two Years Ago (bushels/acre) ............... : 30.00
Nitrogen Applied 2 Years Ago (pounds/acre) ....... : 60
Soil Test Value for Nitrate Nitrogen 2 Years Ago . : 0
Is there a rotational crop requirement (Y,N)? .... : N

F1-Help;           ESC-Abort;           F10-End editing;
PGUP-Prev Screen   PGDN-Next Screen
```

Figure 4. History of yields and nitrogen fertilization practices for this field.

Yield Average (bushels/acre):

Enter the average yield over the last 10 years for this crop and field. (If you do not have records, use your best estimate.)

Crop Grown Last Year:

Enter the crop grown in this field one year ago.

Yield Last Year (bushels/acre):

Enter the approximate yield for this crop in this field last season.

Nitrogen Applied Last Year (pounds/acre):

Enter the amount of fertilizer nitrogen applied last season.

Soil Test Value for Nitrate Nitrogen Last Year:

Amount of available nitrate nitrogen reported in the soil test for last year.

Nitrogen Applied Two Years Ago (pounds\acre):

Total amount of fertilizer nitrogen applied to this field two years ago.

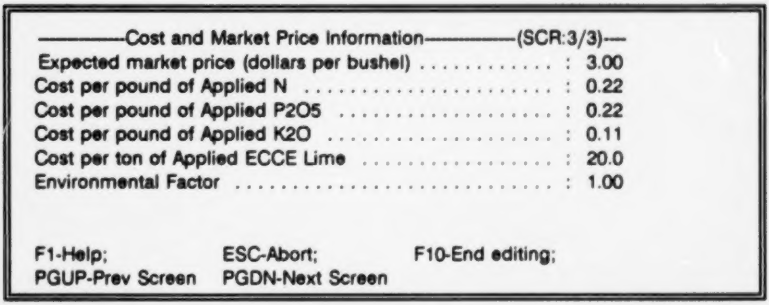
Soil Test Value for Nitrogen Nitrate 2 Years Ago:

Amount of available nitrate nitrogen reported in the soil test for 2 years ago.

Is there a rotational crop requirement (Y,N)?:

Answer yes if a legume will be grown in rotation with the crop planned for this season, otherwise answer no.

Screen 3, shown in Figure 5, is used to enter the cost of fertilizer nutrients, the expected value of the crop, and a general environmental index.



```
————————Cost and Market Price Information————————(SCR:3/3)——
 Expected market price (dollars per bushel) ............ :  3.00
 Cost per pound of Applied N ........................... :  0.22
 Cost per pound of Applied P2O5 ........................ :  0.22
 Cost per pound of Applied K2O ......................... :  0.11
 Cost per ton of Applied ECCE Lime ..................... :  20.0
 Environmental Factor .................................. :  1.00


 F1-Help;             ESC-Abort;             F10-End editing;
 PGUP-Prev Screen     PGDN-Next Screen
```

Figure 5. Screen for economic inputs.

Expected market (dollars per bushel):

This is the price at which you expect to sell the crop, minus variable harvest cost directly related to yield (i.e. cost per bushel for hauling grain; cost per ton for cutting and baling hay, etc.).

Cost per pound of Applied Nitrogen:

This is the cost of each pound of Nitrogen applied to your field. It should include the cost of the application.

Cost per pound of Applied P_2O_5:

This is the cost of each pound of P_2O_5 (including application costs) applied to your field.

Cost per pound of Applied K_2O:

This the cost of each pound of K_2O applied to your field including application costs.

Cost per ton of Applied ECCE Lime:

This is the cost of each ton of ECCE (Effective Calcium Carbonate Equivalent) lime applied to your field. Be sure to enter the cost of ECCE lime, not bulk lime. This cost should include the cost of the application.

Environmental Factor:

This factor is an estimate of the effect of all other growth and environmental factors which may influence your crop. It is a number between 0 and 1.0. A value of 1.0 indicates that all other environmental factors are controlled or are present at levels which will support the yield goal. A value of 0 indicates the crop will be a total failure. This factor is used to calculate the impact of weather, diseases, insects, weeds, etc. upon crop yield. A value of 0.8 indicates a 20% yield loss due to these factors. You may want to experiment with several values of this factor to get an estimate of the effect of its value on the selected fertilizer practices.

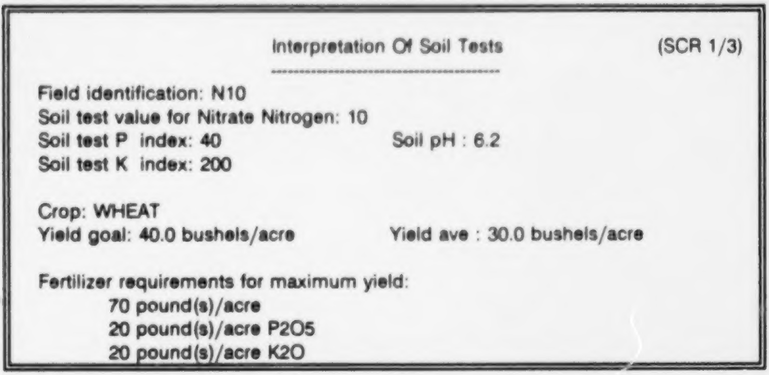
After entering all the data and verifying that they are correct, the <F10> key should be pressed to end the editing process and cause the NPK$PLUS program to start calculating. If values are requested which are unknown to you, enter your best estimate. Figures 6 and 7 show the results, using default values produced by this option for figures 3,4, and 5. The <PgUp> and <PgDn> keys can be used to switch back and forth between the output screens.

In this software, return is defined as the increase in income from a fertilized crop in excess of the cost of the fertilizer compared to income which would have been realized without any fertilization. Percent return is the return divided by the fertilizer cost (expressed as a percent). Note that in this example (Fig. 6), the fertilizer rate recommended for long-term productivity and maximum yield is not one of the top 10 options for maximum short-term (this year) economic return (Fig.7).

A summary of input assumptions used in the projections is presented on the final output screen (Fig.8).

Repeat Projections:

The influence of changing one or more of the values used on the projected output can be easily obtained by first pressing <ESC>, selecting OPTION A, and entering the new value. Previously used values will remain as new default values. CAUTION. When changing from one field to another be sure to examine all default values carefully and input appropriate new values.

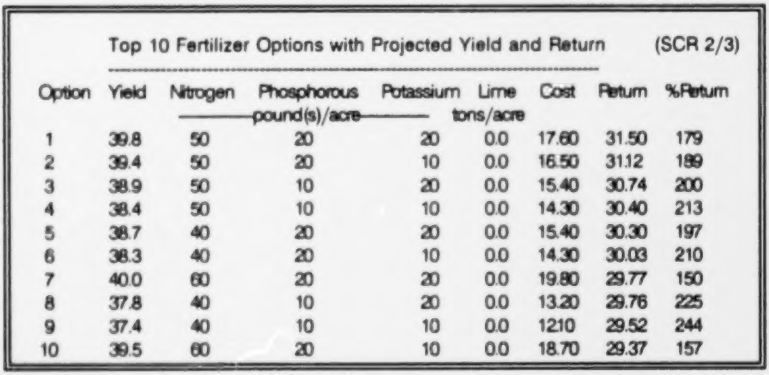


```
                    Interpretation Of Soil Tests              (SCR 1/3)
                    ---------------------------------
Field identification: N10
Soil test value for Nitrate Nitrogen: 10
Soil test P  index: 40                 Soil pH : 6.2
Soil test K  index: 200

Crop: WHEAT
Yield goal: 40.0 bushels/acre          Yield ave : 30.0 bushels/acre

Fertilizer requirements for maximum yield:
        70 pound(s)/acre
        20 pound(s)/acre P2O5
        20 pound(s)/acre K2O
```

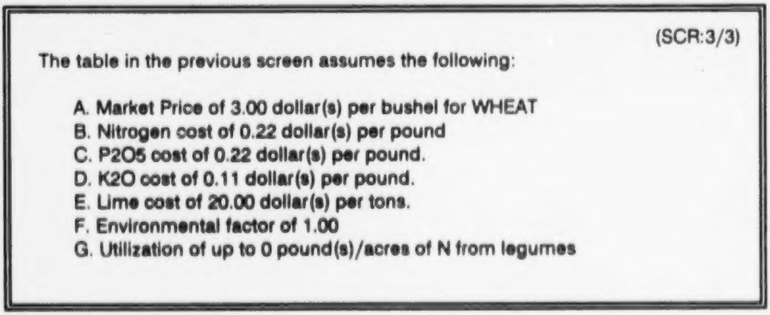
Figure 6. Interpretation of soil test for long-term fertilizer management of field N10.



Top 10 Fertilizer Options with Projected Yield and Return (SCR 2/3)

Option	Yield	Nitrogen	Phosphorous	Potassium	Lime	Cost	Return	%Return
		pound(s)/acre			tons/acre			
1	39.8	50	20	20	0.0	17.60	31.50	179
2	39.4	50	20	10	0.0	16.50	31.12	189
3	38.9	50	10	20	0.0	15.40	30.74	200
4	38.4	50	10	10	0.0	14.30	30.40	213
5	38.7	40	20	20	0.0	15.40	30.30	197
6	38.3	40	20	10	0.0	14.30	30.03	210
7	40.0	60	20	20	0.0	19.80	29.77	150
8	37.8	40	10	20	0.0	13.20	29.76	225
9	37.4	40	10	10	0.0	12.10	29.52	244
10	39.5	60	20	10	0.0	18.70	29.37	157

Figure 7. Top 10 short-term fertilization options for field N10.



(SCR:3/3)

The table in the previous screen assumes the following:

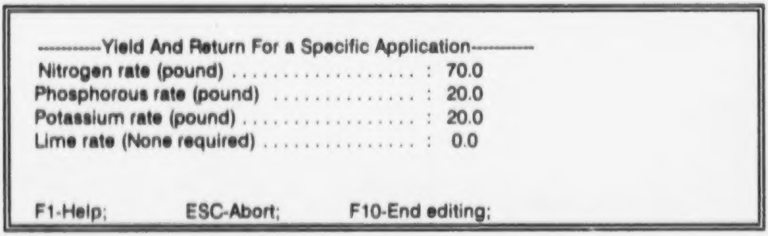
A. Market Price of 3.00 dollar(s) per bushel for WHEAT
B. Nitrogen cost of 0.22 dollar(s) per pound
C. P2O5 cost of 0.22 dollar(s) per pound.
D. K2O cost of 0.11 dollar(s) per pound.
E. Lime cost of 20.00 dollar(s) per tons.
F. Environmental factor of 1.00
G. Utilization of up to 0 pound(s)/acres of N from legumes

Figure 8. Summary of Assumptions used for Last Projection.

USING OPTION B
Calculate Yield and Estimated Return for a Specific Fertilizer Application

Frequently, a person is interested in determining the yield, cost, and return on a fertilizer investment for a specific application rate not identified by Option A. To determine this, Option A must first be run. If that option has not been run, the user will need to enter those parameters at the beginning of this option. The system then assumes the user is wanting to determine the economics of a fertilization for that field. To exercise OPTION B press <ESC>, <B>, and <F10>, then enter the values for nitrogen, phosphorus, potassium and lime to be evaluated.

Recall that for the field used in Option A, the fertilizer requirement for maximum yield was not one of the 10 best options. If the user is interested in the economics for that option, the entries shown in Figure 9 would be made.



```
-----------Yield And Return For a Specific Application----------
Nitrogen rate (pound) . . . . . . . . . . . . . . . . . . :  70.0
Phosphorous rate (pound)  . . . . . . . . . . . . . . . :  20.0
Potassium rate (pound) . . . . . . . . . . . . . . . . . :  20.0
Lime rate (None required) . . . . . . . . . . . . . . . :   0.0


F1-Help;           ESC-Abort;           F10-End editing;
```

Figure 9. Data entry screen for a specific application rate.

Nitrogen rate (pounds/acre):

This is the amount of nitrogen to be used in the calculation.

Phosphorous rate (pounds/acre):

This is the amount of P_2O_5 to be used in calculations.

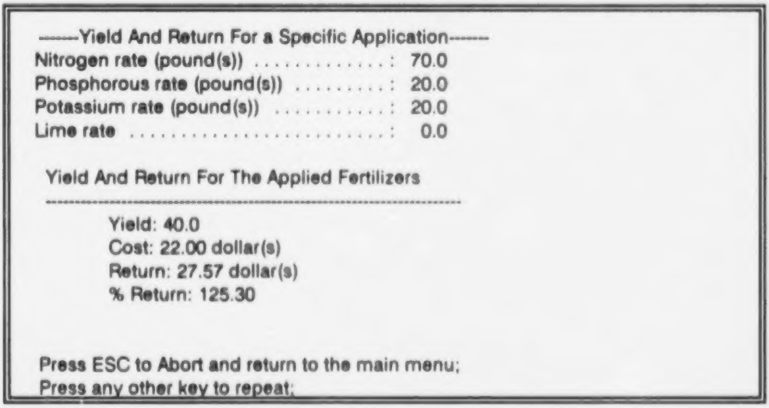
Potassium rate (pounds/acre):

This is the amount of K_2O to be used in calculations.

Lime rate (0.0 tons/acre):

This is the amount of lime used in the calculations.

When these entries have been made and verified, press the <F10> key. The bottom part of the screen will be cleared and the results displayed as shown in Figure 10.



```
 ------Yield And Return For a Specific Application------
Nitrogen rate (pound(s)) . . . . . . . . . . . . . :  70.0
Phosphorous rate (pound(s))  . . . . . . . . . :  20.0
Potassium rate (pound(s))  . . . . . . . . . . . :  20.0
Lime rate  . . . . . . . . . . . . . . . . . . . . . . . . :   0.0

  Yield And Return For The Applied Fertilizers
 ---------------------------------------------------------------
          Yield: 40.0
          Cost: 22.00 dollar(s)
          Return: 27.57 dollar(s)
          % Return: 125.30


 Press ESC to Abort and return to the main menu;
 Press any other key to repeat;
```

Figure 10. Results for a user-specified fertilizer rate.

After the screen shown in Figure 10 is displayed, the user may press the <ESC> key to return to the main menu. Pressing any other key will display Figure 9 again to enable the user to enter another fertilizer practice.

USING OPTION C

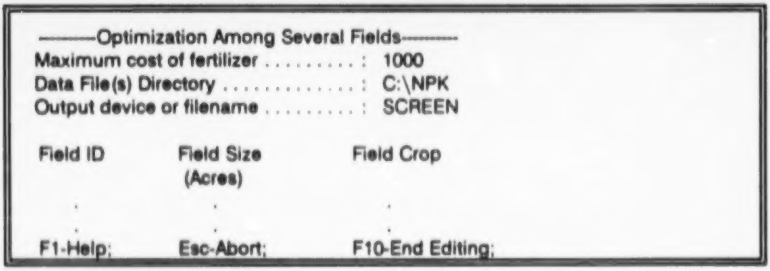
Find Best Fertilizer Application Rates Among Fields for Limited Fertilizer Investment.

Although results from Option A can be helpful for individual fields, producers often manage several fields and want to use their money most effectively for the entire farming enterprise. Therefore, a management tool is needed which deals with the entire farm rather than with only one field. That is the purpose of this option.

Option C enables the user to define parameters for each field just as is done in the case of an analysis of one field. Yields, fertilizer costs, and returns on fertilizer investments are then determined for all possible fertilizer rates from zero to the amounts required to completely correct deficiencies for the crop in increments of 10 pounds per acre for each nutrient. The results for each field are then stored in a disk file.

When the user has completed entering parameters for all of the fields of interest, the system then examines the possible combinations of fertilizer use and determines which combination provides the greatest return while keeping the total fertilizer cost below some user-specified amount. That combination of fertilizer rates, total cost, and total return for the collection of fields is then displayed.

Figure 11 shows the main data-entry screen for this option.



```
--------Optimization Among Several Fields---------
Maximum cost of fertilizer . . . . . . . . . :  1000
Data File(s) Directory . . . . . . . . . . . . . :  C:\NPK
Output device or filename . . . . . . . . . :  SCREEN

Field ID          Field Size          Field Crop
                   (Acres)
    .                 .                   .
    .                 .                   .
F1-Help;          Esc-Abort;          F10-End Editing;
```

Figure 11. Data-entry screen for Option C.

Maximum Cost of Fertilizer:

This entry is the maximum amount of money to be spent on fertilizer for the set of fields to be considered.

Data File(s) Directory:

This entry allows the user to specify the disk drive and subdirectory to be used for storing data files. In this case, the files will be stored on drive C, subdirectory NPK.

Output Device or File Name:

Results of this option can be displayed on the screen or printer or stored in an ASCII text file. This entry should be SCREEN, PRINTER, or a legal DOS file name indicating the destination of the output from this option.

Field ID:

This is the identifier for one field. Because the results are written to a disk file, this identifier must be a legal file name since the field ID will become the name of the file containing information about this field. After you enter the field ID, the computer searches the directory specified in line 2 of the screen for a file by that name. If it is found, the size and crop for that field are read and placed on the screen. If the file is not found, the three screens used in Option A are presented and the user is allowed to fill in that data for this field.

Field Size:

This is the area of the field specified above.

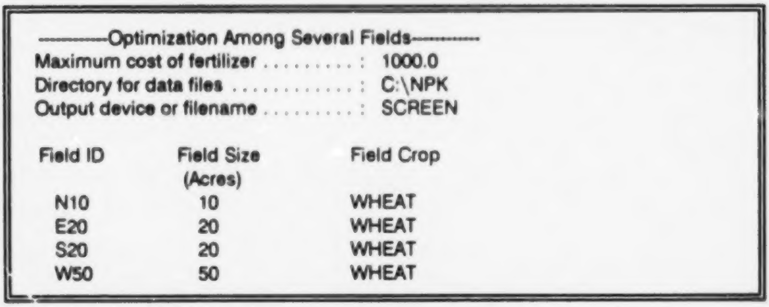
Field Crop:

This is the name of the crop to be grown in this field. The list of crops is the same as that specified in Option A. It will be displayed if the <F1> key is pressed when the cursor is in this column.

When all of the entries have been made for the fields of interest, press the <F10> to begin processing.

NOTE: This computational process may be quite time consuming for more than four fields. The approximate percent of computations completed are shown on the screen during this time. Work is underway to develop an algorithm to solve this problem more rapidly and for a larger number of fields.

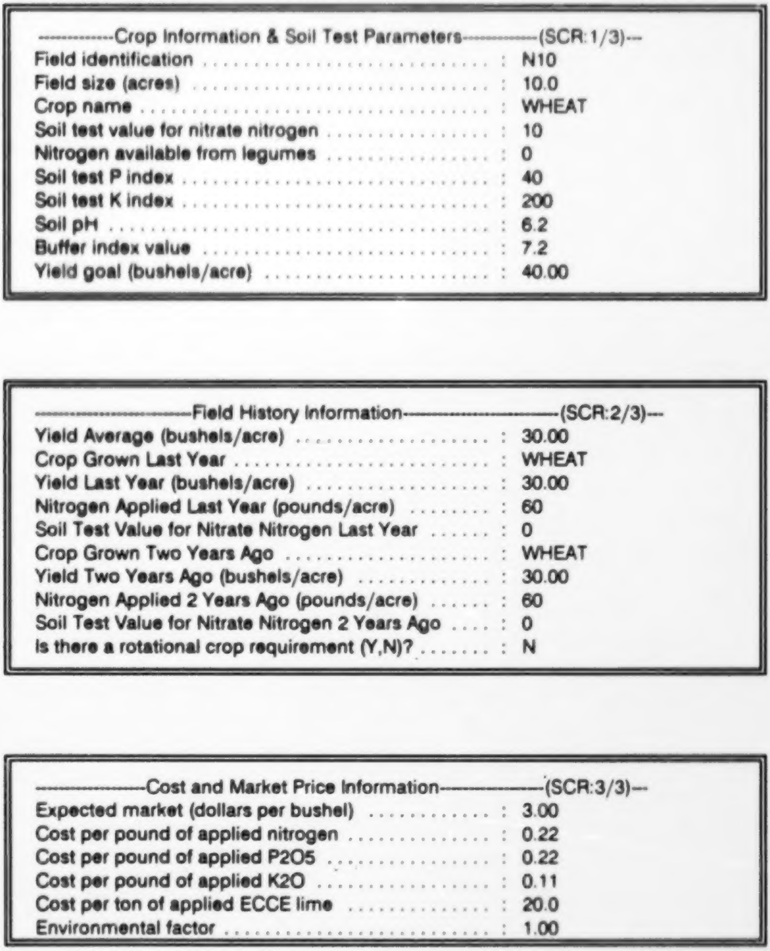
Figure 12 illustrates the use of this option for four fields of wheat. The input parameters used to illustrate this example are shown in figures 13-16, and the results of Option C are shown in Figure 17.



```
----------Optimization Among Several Fields-----------
Maximum cost of fertilizer . . . . . . . . . :  1000.0
Directory for data files . . . . . . . . . . :  C:\NPK
Output device or filename . . . . . . . . . :  SCREEN

Field ID        Field Size         Field Crop
                 (Acres)
  N10              10              WHEAT
  E20              20              WHEAT
  S20              20              WHEAT
  W50              50              WHEAT
```

Figure 12. Data-entry screen with field information.



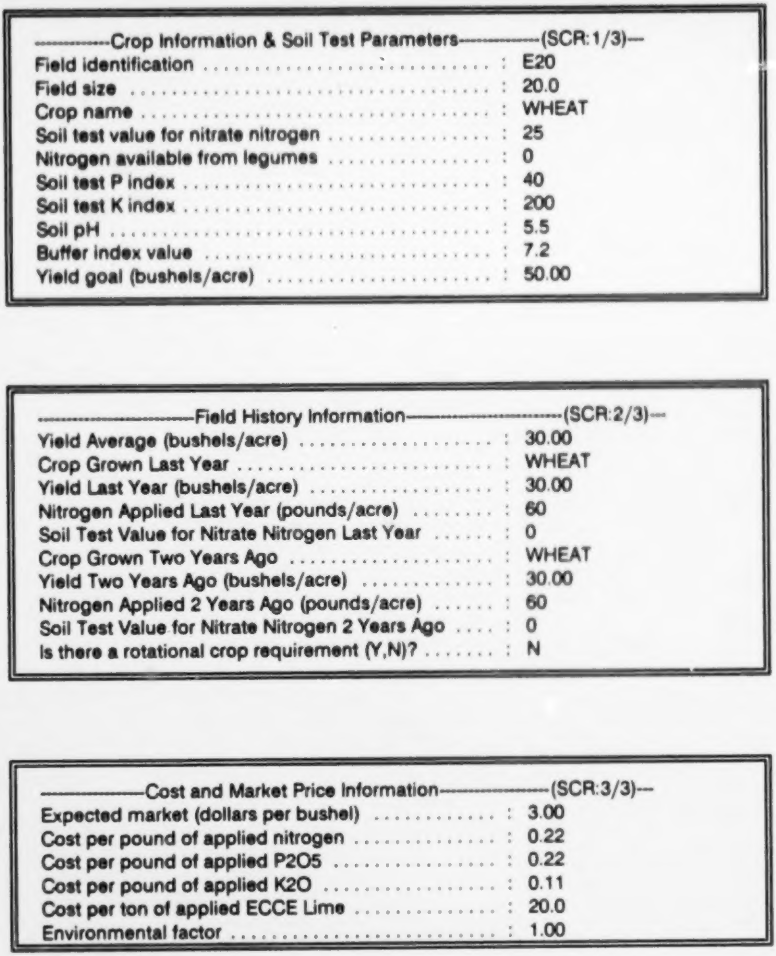
```
-------------Crop Information & Soil Test Parameters-------------(SCR:1/3)--
Field identification . . . . . . . . . . . . . . . . . . . . . . . . :  N10
Field size (acres)  . . . . . . . . . . . . . . . . . . . . . . . . . :  10.0
Crop name . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . :  WHEAT
Soil test value for nitrate nitrogen . . . . . . . . . . . . . . . . :  10
Nitrogen available from legumes  . . . . . . . . . . . . . . . . . . :  0
Soil test P index . . . . . . . . . . . . . . . . . . . . . . . . . . :  40
Soil test K index . . . . . . . . . . . . . . . . . . . . . . . . . . :  200
Soil pH . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . :  6.2
Buffer index value  . . . . . . . . . . . . . . . . . . . . . . . . . :  7.2
Yield goal (bushels/acre) . . . . . . . . . . . . . . . . . . . . . . :  40.00
```

```
------------------------Field History Information------------------------(SCR:2/3)---
Yield Average (bushels/acre) . . . . . . . . . . . . . . . . . . . :  30.00
Crop Grown Last Year . . . . . . . . . . . . . . . . . . . . . . . . :  WHEAT
Yield Last Year (bushels/acre) . . . . . . . . . . . . . . . . . . :  30.00
Nitrogen Applied Last Year (pounds/acre) . . . . . . . . . :  60
Soil Test Value for Nitrate Nitrogen Last Year  . . . . . . :  0
Crop Grown Two Years Ago . . . . . . . . . . . . . . . . . . . . :  WHEAT
Yield Two Years Ago (bushels/acre)  . . . . . . . . . . . . . :  30.00
Nitrogen Applied 2 Years Ago (pounds/acre) . . . . . . :  60
Soil Test Value for Nitrate Nitrogen 2 Years Ago . . . . :  0
Is there a rotational crop requirement (Y,N)? . . . . . . . :  N
```

```
-----------------Cost and Market Price Information-----------------(SCR:3/3)--
Expected market (dollars per bushel)  . . . . . . . . . . . . :  3.00
Cost per pound of applied nitrogen . . . . . . . . . . . . . . :  0.22
Cost per pound of applied P2O5 . . . . . . . . . . . . . . . . :  0.22
Cost per pound of applied K2O . . . . . . . . . . . . . . . . . :  0.11
Cost per ton of applied ECCE lime  . . . . . . . . . . . . . . :  20.0
Environmental factor . . . . . . . . . . . . . . . . . . . . . . . . :  1.00
```

Figure 13. Input parameters for field N10.

1003

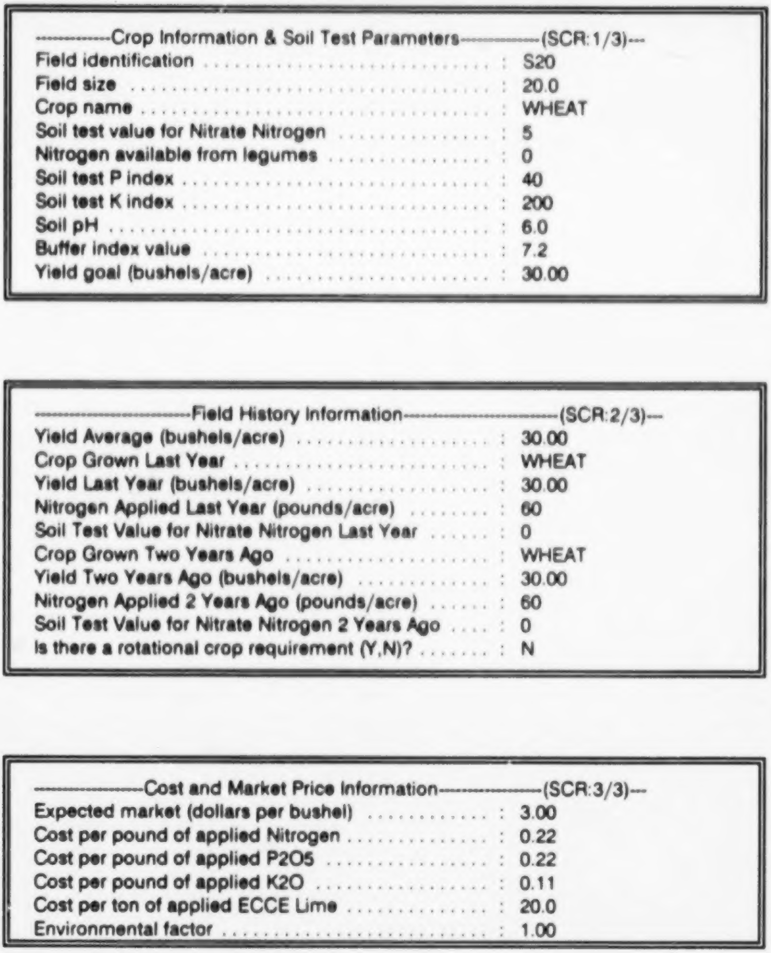


```
-------------Crop Information & Soil Test Parameters-------------(SCR:1/3)--
Field identification ............................ : E20
Field size ...................................... : 20.0
Crop name ....................................... : WHEAT
Soil test value for nitrate nitrogen ............ : 25
Nitrogen available from legumes ................. : 0
Soil test P index ............................... : 40
Soil test K index ............................... : 200
Soil pH ......................................... : 5.5
Buffer index value .............................. : 7.2
Yield goal (bushels/acre) ....................... : 50.00
```

```
------------------------Field History Information------------------------(SCR:2/3)--
Yield Average (bushels/acre) .................... : 30.00
Crop Grown Last Year ............................ : WHEAT
Yield Last Year (bushels/acre) .................. : 30.00
Nitrogen Applied Last Year (pounds/acre) ........ : 60
Soil Test Value for Nitrate Nitrogen Last Year ...... : 0
Crop Grown Two Years Ago ........................ : WHEAT
Yield Two Years Ago (bushels/acre) .............. : 30.00
Nitrogen Applied 2 Years Ago (pounds/acre) ...... : 60
Soil Test Value for Nitrate Nitrogen 2 Years Ago .... : 0
Is there a rotational crop requirement (Y,N)? ....... : N
```

```
---------------Cost and Market Price Information---------------(SCR:3/3)--
Expected market (dollars per bushel) ............ : 3.00
Cost per pound of applied nitrogen .............. : 0.22
Cost per pound of applied P2O5 .................. : 0.22
Cost per pound of applied K2O ................... : 0.11
Cost per ton of applied ECCE Lime ............... : 20.0
Environmental factor ............................ : 1.00
```

Figure 14. Input parameters for field E20.



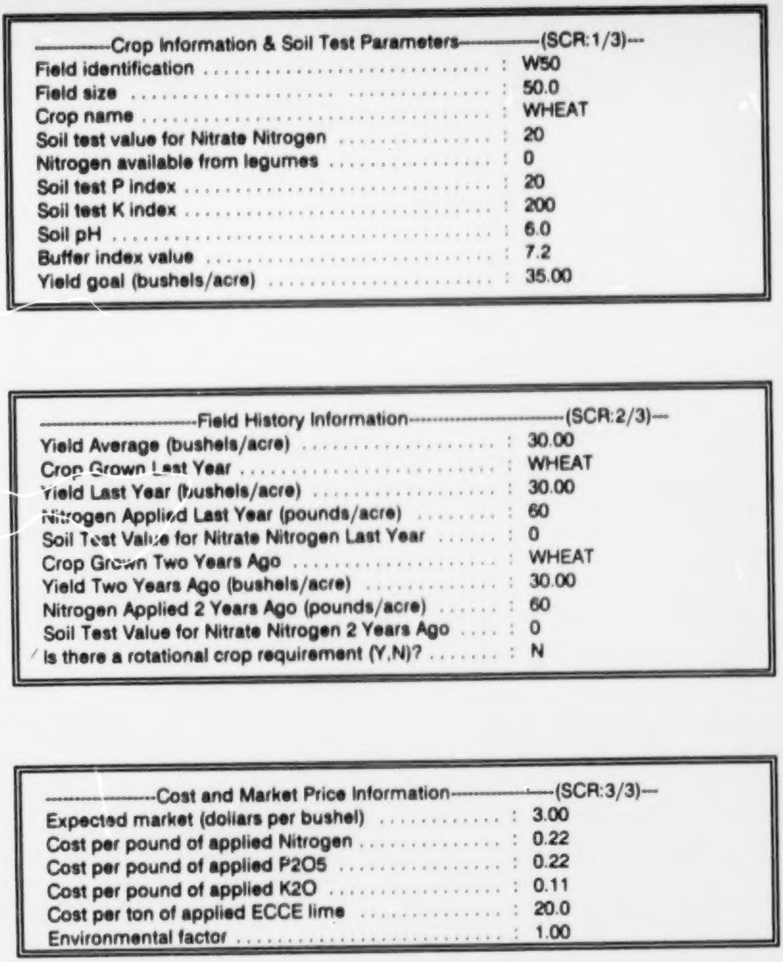
```
--------------Crop Information & Soil Test Parameters--------------(SCR:1/3)---
Field identification . . . . . . . . . . . . . . . . . . . . . . . . . . . . :  S20
Field size . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . :  20.0
Crop name . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . :  WHEAT
Soil test value for Nitrate Nitrogen . . . . . . . . . . . . . . . :  5
Nitrogen available from legumes . . . . . . . . . . . . . . . . . :  0
Soil test P index . . . . . . . . . . . . . . . . . . . . . . . . . . . . :  40
Soil test K index . . . . . . . . . . . . . . . . . . . . . . . . . . . . :  200
Soil pH . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . :  6.0
Buffer index value . . . . . . . . . . . . . . . . . . . . . . . . . . . :  7.2
Yield goal (bushels/acre) . . . . . . . . . . . . . . . . . . . . . . :  30.00
```

```
---------------------------Field History Information---------------------------(SCR:2/3)---
Yield Average (bushels/acre) . . . . . . . . . . . . . . . . . . . :  30.00
Crop Grown Last Year . . . . . . . . . . . . . . . . . . . . . . . . :  WHEAT
Yield Last Year (bushels/acre) . . . . . . . . . . . . . . . . . . :  30.00
Nitrogen Applied Last Year (pounds/acre) . . . . . . . . . :  60
Soil Test Value for Nitrate Nitrogen Last Year . . . . . . :  0
Crop Grown Two Years Ago . . . . . . . . . . . . . . . . . . . . . :  WHEAT
Yield Two Years Ago (bushels/acre) . . . . . . . . . . . . . . :  30.00
Nitrogen Applied 2 Years Ago (pounds/acre) . . . . . . . :  60
Soil Test Value for Nitrate Nitrogen 2 Years Ago . . . . :  0
Is there a rotational crop requirement (Y,N)? . . . . . . . :  N
```

```
--------------------Cost and Market Price Information--------------------(SCR:3/3)---
Expected market (dollars per bushel) . . . . . . . . . . . . :  3.00
Cost per pound of applied Nitrogen . . . . . . . . . . . . . . :  0.22
Cost per pound of applied P2O5 . . . . . . . . . . . . . . . . :  0.22
Cost per pound of applied K2O . . . . . . . . . . . . . . . . . :  0.11
Cost per ton of applied ECCE Lime . . . . . . . . . . . . . . :  20.0
Environmental factor . . . . . . . . . . . . . . . . . . . . . . . . :  1.00
```

Figure 15. Input parameters for field S20.

1005

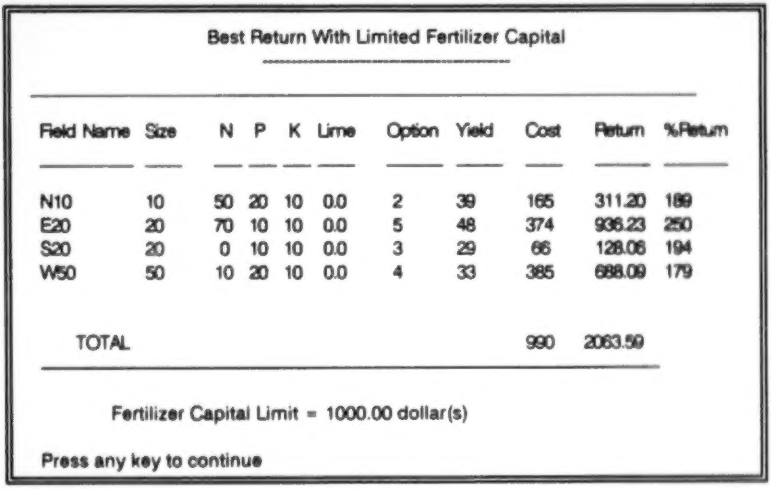


```
-----------Crop Information & Soil Test Parameters-----------(SCR:1/3)---
Field identification . . . . . . . . . . . . . . . . . . . . . . . : W50
Field size . . . . . . . . . . . . . . . . . . . . . . . . . . . . : 50.0
Crop name . . . . . . . . . . . . . . . . . . . . . . . . . . . . : WHEAT
Soil test value for Nitrate Nitrogen . . . . . . . . . . . . . . . : 20
Nitrogen available from legumes . . . . . . . . . . . . . . . . . : 0
Soil test P index . . . . . . . . . . . . . . . . . . . . . . . . : 20
Soil test K index . . . . . . . . . . . . . . . . . . . . . . . . : 200
Soil pH . . . . . . . . . . . . . . . . . . . . . . . . . . . . . : 6.0
Buffer index value . . . . . . . . . . . . . . . . . . . . . . . . : 7.2
Yield goal (bushels/acre) . . . . . . . . . . . . . . . . . . . . : 35.00
```

```
----------------------Field History Information----------------------(SCR:2/3)--
Yield Average (bushels/acre) . . . . . . . . . . . . . . . . . . . : 30.00
Crop Grown Last Year . . . . . . . . . . . . . . . . . . . . . . . : WHEAT
Yield Last Year (bushels/acre) . . . . . . . . . . . . . . . . . . : 30.00
Nitrogen Applied Last Year (pounds/acre) . . . . . . . . . . . . . : 60
Soil Test Value for Nitrate Nitrogen Last Year . . . . . . . . . . : 0
Crop Grown Two Years Ago . . . . . . . . . . . . . . . . . . . . . : WHEAT
Yield Two Years Ago (bushels/acre) . . . . . . . . . . . . . . . . : 30.00
Nitrogen Applied 2 Years Ago (pounds/acre) . . . . . . . . . . . . : 60
Soil Test Value for Nitrate Nitrogen 2 Years Ago . . . . . . . . . : 0
Is there a rotational crop requirement (Y,N)? . . . . . . . . . . : N
```

```
----------------Cost and Market Price Information---------------(SCR:3/3)--
Expected market (dollars per bushel) . . . . . . . . . . . . . . . : 3.00
Cost per pound of applied Nitrogen . . . . . . . . . . . . . . . . : 0.22
Cost per pound of applied P2O5 . . . . . . . . . . . . . . . . . . : 0.22
Cost per pound of applied K2O . . . . . . . . . . . . . . . . . . : 0.11
Cost per ton of applied ECCE lime . . . . . . . . . . . . . . . . : 20.0
Environmental factor . . . . . . . . . . . . . . . . . . . . . . . : 1.00
```

Figure 16. Input parameters for field W50.



```
                  Best Return With Limited Fertilizer Capital
                  -------------------------------------------
______________________________________________________________________________

Field Name  Size   N   P   K  Lime   Option  Yield   Cost   Return   %Return
__________  ____  __  __  __  ____   ______  _____   ____   ______   _______

N10          10   50  20  10  0.0      2      39     165    311.20   189
E20          20   70  10  10  0.0      5      48     374    936.23   250
S20          20    0  10  10  0.0      3      29      66    128.06   194
W50          50   10  20  10  0.0      4      33     385    688.09   179


    TOTAL                                            990   2063.59
__________________________________________________________________

        Fertilizer Capital Limit =  1000.00 dollar(s)

Press any key to continue
```

Figure 17. Best Return with Limited Fertilizer Capital

If you want to change any of the information on a crop for an already existing file, such as file N10 for field N10, press <F8> (Edit field parameters) and the data entry screens, similar to those in Figures 13 through 16, will be displayed again. Use the <PgDn> or <PgUp> keys to find the screen you want to edit. Make changes to any of the three screens as necessary and press <F10> when finished. After data has been entered press <F10> again. The computer will make calculations, and the screen (similar to Figure 17) will display the results.

Perhaps you want to compare the yield and profit potential of field N10 with corn, rather than wheat. To do this, move the cursor down to the next blank line under Field ID and type in the new DOS filename. Enter a representative name such as N10-CORN and press <ENTER>. The program will display a new set of data entry screens as above.

1007

MATHEMATICAL BASIS OF MODEL

The model used in this program is derived from the general equation below

$$Y = f\,(YG, EF, CRN) \qquad [1]$$

which shows crop yield as a function of the yield goal, the environment, and the crop response to required plant nutrients, where:

Y = That portion of the crop removed from the field (harvested).

YG = Yield goal. This is the highest yield of this crop expected 1 out of 5 years on this field.

EF = Environmental factor. The degree to which conditions of weather, absence of pests (weeds, disease, etc.) and cultural or management practices allow attainment of the yield goal. A value of 1.0 is most optimistic while a value of 0.8 assumes a 20% crop failure.

CRN = Crop response to the nutrients nitrogen (N), phosphorus (P) and potassium (K) as they may exist in available forms at various levels in the soil or as they are supplied through fertilization.

The product of YG and EF is the yield possibility. (Yield when all nutrients are present in adequate, but not toxic amounts for weather and other growing conditions specific to the location.)

1003

Expansion of equation (1) to further describe response to N, P, and K leads to the following series of mathematical expressions. First of all, the equation below shows yield as a product of separate components for N, P and K response. Within each component are terms to identify different forms or sources of the nutrient.

$$Y = EF(Y_{NI} + Y_{NO})(PSP + FP)(PSK + FK) \qquad [2]$$

Where:

Y_{NI} = Yield response to inorganic N

Y_{NO} = Yield response to organic available N

PSP = Yield response to soil P (percent sufficiency of soil P)

FP = Yield response to fertilizer P_2O_5

PSK = Yield response to soil K (percent sufficiency of soil K)

FK = Yield response to fertilizer K_2O

The percent sufficiency of P or K is the yield without added nutrient (only the nutrient in question is limiting) divided by the yield from the same location when that nutrient is provided in adequate amounts. See Figure 18 for an example of the soil test calibration related to percent sufficiency.

	SMALL GRAIN	
P Soil Test Index*	Percent Sufficiency	Fertilizer P_2O_5 lbs/A
0	25	80
10	45	60
20	80	40
40	90	20
65+	100	None

	SMALL GRAIN	
K Soil Test Index**	Percent Sufficiency	Fertilizer K_2O lbs/A
0	50	60
75	70	50
125	80	40
200	95	20
250+	100	None

* Bray P_1 soil test value

** Ammonium acetate exchangeable K soil test value

Figure 18. P and K percent sufficiency soil test calibration for small grains

SMALL GRAINS

Yield Goal Bu/A			N lbs/A
Wheat	Barley	Oats	
15	20	25	30
20	25	35	40
30	35	55	60
40	50	70	80
50	60	90	100
60	75	105	125
70	90	125	155
80	100	140	185
100	125	175	240

Figure 19. Yield goal based N requirement for selected small grains

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Y_{NI} is defined mathematically by:

$$Y_{NI} = YG\left(\frac{1-(NR-(STN+FN))}{NR}\right) \qquad [3]$$

and, $(STN + FN) \leq NR$

Where:

NR = The required nitrogen identified by the yield goal (see Figure 19).

STN = The amount of nitrate N available as shown by a recent soil test.

FN = The amount of fertilizer N applied.

The response to organic N is given by

$$Y_{NO} = (YG-Y_{NI})\left(\frac{1-NR_2-RN}{NR_2}\right) \qquad [4]$$

Where: $NR_2 = NR - (STN + FN)$

and, $RN \leq NR_2$ and is described by:

$$RN = \left(\frac{YA}{YG}\right)^2\left(1-\left(\frac{STN+FN}{NR}\right)^2\right)NR+L \qquad [5]$$

Where:

YA = Long-term (10-20 years) yield average.

L = Contribution of N from a legume grown the previous year or animal manure additions.

The yield response to available organic $N(Y_{NO})$ incorporates mathematical expressions of a new theory which has been advanced to allow indexing of this form of N which cannot be reliably measured at this time.

THEORY

RESIDUAL AVAILABLE ORGANIC NITROGEN (RN) WILL EQUAL THE NITROGEN REQUIREMENT (NR) FOR YIELD WHEN THE YIELD GOAL (YG) IS EQUAL TO THE YIELD AVERAGE (YA) AND THE YIELD AVERAGE IS BASED ON MANY CONSECUTIVE YEARS (PERHAPS 20) OF DATA.

It follows that residual available organic N will approach zero as the yield average approaches zero. These conditions may be expressed by

$$RN = NR\left(1 - \frac{YG-YA}{YG}\right) \qquad [6]$$

This theory identifies the amount of available organic N put in reserve by indexing the degree to which the yield average was produced in an N rich environment. Our best example of production in an N rich environment is with high yielding legumes such as alfalfa production. Alfalfa grows in an N rich environment and contributes each year to a reserve of organic available N. This N is used when wheat or another non-legume crop following alfalfa produces high yields without the use of fertilizer (or high soil test N) N. A similar reserve is built up in continuous wheat production when each year the fertilizer N provided is adequate to assure N will never be deficient during the season. This reserve of N will only be used if there is a shortage of inorganic N.

Thus, N from the reserve of organic available N will only be used when there is insufficient soil test and fertilizer n to meet the requirements of the current crop. Since the size of this reserve will be dependent upon the suitability of climatic conditions for accumulating and storing organic N, cool temperate climates will be more favorable than warm desert climates. In relation to the total available annually, the size of the reserve may range from 1 or 2 in the warm desert extremes to 20 or more times the annual available amount under cool temperate conditions. When the reserve is relatively small, for example, about four times the total available annually, there may be a significant draw down of the reserve in one or two years without affecting the long-term yield average. In order to account for this in the model, an adjusted yield average (AYA) is used to index RN using the equation:

$$AYA = YA\left(1 - \frac{ADD}{4NR(\frac{YA}{YG})^2}\right) \qquad [7]$$

Where: ADD = Accumulative drawdown calculated from:

$$ADD = RODD' + RODD'' \qquad [8]$$

and

$$RODD' = \left(\frac{Y'}{YG'}\right)NR' - (FN' + STN') \qquad [9]$$

RODD' and RODD" are the residual organic drawdown in lbs N/ac for last year (') and two years ago("), respectively.

An illustration of how yield response to N fertilizer (or soil test N) is influenced by residual available organic N as indexed by YA is shown by Figure 20.

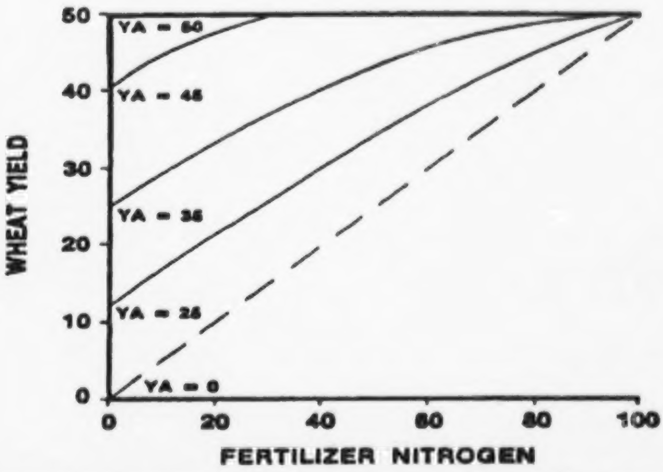

Figure 20. The influence of residual available organic nitrogen on yield response to fertilizer nitrogen.

The yield response to P is assumed to have a quadratic form and is expressed by:

$$Y = \frac{PSP + \left(\frac{2FP}{PD}\right)(100 - PSP) - \left(\frac{FP}{PD}\right)^2 (100 - PSP)}{100} \qquad [10]$$

Where:

PSP = Percent sufficiency P determined from soil test calibration

FP = Rate of fertilizer P_2O_5 applied

PD = P_2O_5 deficiency determined from calibrated soil test

A similar expression is used for the K yield function. The influence of soil test P on response of wheat to applied fertilizer P_2O_5 is illustrated in Figure 21.

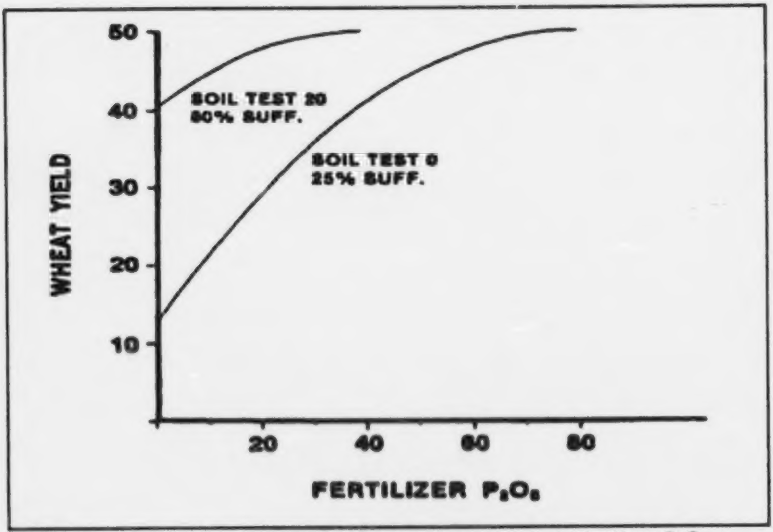

Figure 21. The influence of soil test P on yield response to fertilizer P_2O_5.

A yield rsponse function for lime has not been included because incremental rates are seldom considered by producers. That is, producers usually apply the amount required to remove soil acidity as a yield limitation or they do not apply any lime. Yield limitations related to soil acidity are identified by a percent sufficiency calibration of soil pH for the crop (Fig. 22) similar to that for P and K. The amount of lime required to change the pH to a level where acidity no longer limits yield is identified by the buffer index - lime requirement calibration (Fig. 22) for the target pH of the crop. A linear yield response to lime may be used with the assumption that the lime deficiency will commonly be the rate of lime applied. The linear function can be expressed mathematically as:

$$Y = \frac{PSL + \left(\frac{L}{LD}\right)(100 - PSL)}{100} \qquad [11]$$

Where:

PSL = Percent sufficiency of lime determined from soil test calibration

L = Rate of lime applied

LD = Lime deficiency determined from soil test

	WHEAT		
Soil pH	Percent Sufficiency	Buffer Index	Lime Requirement (Tons/ac)
3.9	0	7.2 to 6.6	0.5
4.1	30	6.5	0.6
4.5	60	6.4	0.8
5.0	85	6.3	0.9
5.5	100	6.2	1.0
		6.1	1.2

Figure 22. Soil pH and lime requirement for wheat.

1015

The final form of the equation to predict yield is given below.

$$
\begin{aligned}
Y = {} & EF*YG(1-(NR-(STN+FN))/NR)+(YG-(YG(1-(NR- \\
& (STN+FN))/NR))(1-(NR-(STN+FN)- \\
& ((YA(1-(((Y'/YG')NR'-(FN'+STN'))+((Y''/YG'')NR''- \\
& (FN''+STN''))/4NR(YA/YG)^2))/YG)^2 \\
& (1-((FN+STN)/NR)^2)NR)+L)/NR-(STN+FN))) \\
& ((PSP+(2FP/PD)(100-PSP)-(FP/PD)^2(100-PSP))/100) \\
& ((PSK+(2FK/KD)(100-PSK)-(FK/KD)^2(100-PSK))/100) \\
& (PSL+(L/LD)(100-PSL))/100 \qquad [12]
\end{aligned}
$$

The computer program was designed to calculate the yield components for P, K and lime first. The yield goal based N requirement was then modified to be the N required to support the yield possible from the P, K, lime, and environmental limitations when they were less than the yield goal. In this way, N is not suggested above what the crop could utilize given P, K, lime and environmental growing constraints.

Conventional procedures were used to calculate crop value and cost of fertilizer used. The dollar return from fertilizer use was calculated by subtracting the cost of fertilizer from the value of the yield response to the fertilizer. Percent return was calculated by dividing the value of the yield response minus the cost of fertilizer by the cost of fertilizer.

1016

SOIL, PLANT, AND CROP SCIENCE

CIMC

READING SKILLS

UNITS OF INSTRUCTION	Reading Comprehension									[illegible] and Reference								Functional Reading						Language		Composition						
	Gain factual information	Distinguish fact, opinion and inference	Recognize stereotyping and bias	Recognize propaganda	Analyze cause and effect	Draw conclusions	Make generalizations	React to written material	Apply word analysis techniques	Select useful resources	Locate resources	Find materials in library	Use standard references	Use in-book reference tools	Use audiovisual media	Use computer data base	Use magazines and newspapers	Interpret forms and records	Follow written instructions	Interpret graphics and symbols	Use content area vocabulary	Interpret abbreviations/acronyms	Read aloud	Use standard grammar and correct spelling, punctuation, and capitalization	State ideas clearly	Use complete sentences	Develop preliminary outline	Use topic sentences	Use introductory/closing paragraphs	Compose reports	Compose essays	Proofread and edit
Section A										●	●													●	●	●						
Unit 1 Introduction to Soil, Plant, and Crop Science 1.																								●	●	●						
Unit 2 Safety 2.																		●				●		●	●	●	●					
Unit 3 Careers 3.	●									●	●			●		●																
Section B																																
Unit 1 Soils 1.																		●	●		●			●	●							
Unit 2 Soil Sampling 2.																			●													
Unit 3 Fertilizers 3.	●									●	●			●		●								●	●	●				●		
Unit 4 Soil Conservation Practices 4.	●																							●	●							
Section C																																
Unit 1 Land Uses and Classification 1.	●					●													●		●											
Unit 2 Legal Land Description 2.																				●												
Section D																																
Unit 1 Growth and Reproduction 1.	●									●	●																					
Unit 2 Seeds and Plants: Selection, Preparation, and Planting 2.	●					●												●			●											
Unit 3 Common Pests 3.	●																															
Unit 4 Controlling Pests 4.	●					●													●		●			●	●							
Unit 5 Native and Improved Pastures 5.																								●	●	●						
Unit 6 Harvesting 6.										●	●													●	●							
Section E																								●	●							
Unit 1 Marketing Crops and Grades 1.	●					●							●																			
Unit 2 Price Trends and Cycles 2.																																

CIMC BASIC SKILLS DOCUMENTATION

WRITING SKILLS

MATH SKILLS

	Research					Functional Writing							Operation and Calculation														Math Application											Data Analysis and Display									
Construct graphics and symbols	Take notes	Use notecards	Create bibliography	Use footnotes	Outline material	Complete forms and records	Write instructions	Write letters	Write job applications	Write resumes	Use word processing	Use computer graphics	Round off numbers	Estimate answers	Use scientific notations	Use exponential notations	Calculate with whole numbers	Calculate with fractions	Calculate with decimals	Convert whole numbers to fractions	Convert whole numbers to decimals	Solve numerical expressions	Solve formulae and equations	Obtain squares and square roots	Convert units of measure	Perform metric calculations	Solve word problems	Select/apply mathematical formula	Select/apply mathematical procedure	Use English and metric measures	Solve time/rate/distance problems	Solve ratio/proportion problems	Solve percent problems	Apply techniques of scaling	Apply algebra principles	Apply geometry principles	Apply trigonometry principles	Interpret charts and tables	Interpret graphs (type)	Collect /record data	Apply sampling techniques	Apply principles of probability	Construct charts and tables	Construct graphs	Calculate statistics	Interpret statistics	Interpret blueprints/plans
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MATRIX

SCIENCE SKILLS

	Functional Math														General Science									Life Science							Physical Science					Earth Science							
Interpret blueprints/plans	Make measurements	Perform banking transactions	Make change	Solve practical problems	Calculate gross earnings	Solve income/expense problems	Prepare a budget	Calculate interest	Solve interest problems	Calculate sales tax	Determine income tax	Use calculator for computation	Use computer for computation	Use computer spreadsheets	Apply computing skills	Apply scientific method of inquiry	Conduct experiments	Investigate science ethics	Investigate science history	Investigate/apply economics in technology	Use scientific instruments	Investigate/apply technology	Collect specimens	Identify/classify living organisms	Investigate biological history of the earth	Investigate food chains, webs, pyramids	Investigate/apply principles of human development	Investigate/apply principles of genetics/heredity	Investigate/apply principles of anatomy/physiology	Investigate health issues	Analyze/classify matter	Investigate forms/changes of matter	Investigate forms/changes of energy	Investigate/apply chemical properties	Investigate/apply physical laws	Investigate physical characteristics of the earth	Investigate geological history of the earth	Investigate physical forces acting on the earth	Solve problems of longitude, latitude, and time zones	Investigate conservation of physical resources	Investigate conservation of living resources	Investigate issues of environmental impact	Apply science principles to environmental issues
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ORAL COMMUNICATION SKILLS

	Oral Presentation									Listening				Interactive Communication										General Relations									
UNITS OF INSTRUCTION	Make informative presentations	Make persuasive presentations	Present personal opinion/viewpoint	Use good speaking techniques	Select/use words effectively	Use effective body language	Present approriate appearance	Integrate audio and/or visual materials in oral presentations	Adapt presentation to specific audience	Apply active listening skills	Distinguish fact, opinion, and inference	Draw conclusions/make generalizations	Analyze/identify point of view	Give/follow oral directions	Apply questioning techniques	Conduct/receive interviews	Analyze/apply nonverbal communication	Work effectively in a group	Communicate with clients/customers/patients	Communicate with co-workers	Communicate with supervisors	Communicate with professional colleagues/associates	Apply telephone etiquette	Investigate/apply communication process models	Analyze/apply nonverbal communication	Investigate/apply cross-cultural communication	Interact with co-workers	Interact with supervisors	Interact with clients/customers/patients	Interact with professionalcolleagues/associates	Interact with family/friends	Participate in group activities	Participate in industrial relations/function
Section A																																	
Unit 1 Introduction to Soil, Plant, and Crop Science 1.																																	
Unit 2 Safety 2.																																	
Unit 3 Careers 3.	●			●	●	●	●	●		●						●																	
Section B																																	
Unit 1 Soils 1.																																	
Unit 2 Soil Sampling 2.																																	
Unit 3 Fertilizers 3.																																	
Unit 4 Soil Conservation Practices 4.																																	
Section C																																	
Unit 1 Land Uses and Classification 1.																																	
Unit 2 Legal Land Description 2.																																	
Section D																																	
Unit 1 Growth and Reproduction 1.	●			●		●																											
Unit 2 Seeds and Plants: Selection, Preparation, and Planting 2.																																	
Unit 3 Common Pests 3.																																	
Unit 4 Controlling Pests 4.																																	
Unit 5 Native and Improved Pastures 5.																																	
Unit 6 Harvesting 6.																																	
Section E																																	
Unit 1 Marketing Crops and Grades 1.																																	
Unit 2 Price Trends and Cycles 2.	●			●		●	●																										

INTERPERSONAL OR RELATING SKILLS

CREATIVE THINKING/ PROBLEM SOLVING SKILLS

Identify personal values/attitudes	Apply information to life experiences	Identify values/attitudes	Identify needs/drives	Select/apply appropriate behavior	Investigate/identify personal styles	Investigate/identify group/corporate climate	Give/receive feedback	Identify hidden purposes	Investigate/apply group dynamics	Control undesirable/inappropriate behavior	Resolve conflicts	Clarify goals/objectives	Devise "win/win" situations	Build consensus	Generate ideas	Present point of view	Analyze/apply leadership styles	Analyze/apply management styles	Obtain confidence of others	Develop esteem in self/others	Persuade others	Analyze/apply motivation techniques	Provide positive coaching	Collect/record information	Identify critical elements/issues	Define a problem	Identify underlying causes	Apply a problem-solving model	Analyze/synthesize information	Identify/analyze underlying assumptions	Draw conclusions	Predict results/outcomes	Identify/evaluate consequences	Identify/develop alternatives	Evaluate alternatives	Select an alternative	Devise a solution	Create a finished product	Apply intuitive/creative thinking processes	Transfer knowledge/training to new situations	Apply new technology	Develop an action plan	Evaluate results/outcomes	Analyze personal occupational aptitudes/preferences	Investigate employment prospects of a career field/occupation	Investigate training requirements for a career field/occupation
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BEST COPY AVAILABLE

EMPLOYABILITY SKILLS

SOCIAL STUDIES SKILLS

Analyze personal occupational aptitudes/preferences	Investigate employment prospects of a career field/occupation	Investigate training requirements for a career field/occupation	Investigate benefits of a career field/occupation	Compare/evaluate career options	Develop personal career path	Locate appropriate jobs	Analyze duties/requirements/benefits of specific job	Master specific job task/procedure	Fill in job-related applications	Write letter of application	Write personal resume	Interview for a job	Apply business etiquette	Practice good work habits/attitudes	Develop good personal presentation	Develop self-confidence/esteem	Develop effective leadership	Deal effectively with supervisors	Deal effectively with co-workers	Deal effectively with professional colleagues/associates	Deal effectively with customers/clients	Collect/record data	Interpret graphical information	Construct graphical information	Interpret maps/globes	Interpret statistical information	Analyze/interpret demographic information	Investigate/apply U.S. history	Investigate/apply world history	Investigate/apply U.S. geography	Investigate/apply world geography	Investigate/apply principles of government/politics	Investigate/apply principles of economics	Investigate/apply principles of ethics	Investigate/apply principles of psychology	Investigate/apply principles of sociology	Investigate/apply cross-cultural studies	Practice responsible personal economics	Prepare a personal budget	Use credit responsibly	Practice good work ethics	Participate in industrial relations	Interact with people of different races/cultures	Investigate/participate in government	Investigate/apply American legal practices	Select/use sources of information on current events	Analyze current events	Analyze consumer issues	Analyze social issues	Analyze conservation/ecology issues	Analyze social impact of science/technology	Analyze economic impact of science/technology
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